URS 7004

FINAL REPORT

FIRE FIGHTING OPERATIONS IN HAMBURG, GERMANY DURING WORLD WAR II

OCD Contract No. DAHC20-70-C-0307 Work Unit 2534H

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13. ABSTRACT

Information recorded by the Hamburg Fire Department during World War II has been summarized and analyzed to evaluate several operational parameters relating to the performance of the various fire fighting organizations under conditions of stress from air attacks on the city. Prior to the large-scale attacks, the professional fire fighting units fought at about 38 percent of the fire sites while the Self-Protection Service squads fought at about 59 percent of the fire sites.

Finally, in the major air attacks during the period 7/25/43 to 8/4/43, when the capabilities of both the professional and Self-Protection Units were exceeded, a maximum performance or effort level was reached for the Self-Protection Services at about 2 fire sites/squad per attack and, for the Fire Department Units at about 6 fire sites squad per attack. Because of the failure of the municipal water system and the evacuation (forced and voluntary) of large numbers of people, the Self-Protection Service did not function to any great extent after the first of these large-scale attacks on 7/25/43. However, at the above-indicated rate, the Self-Protection Service was credited with extinguishing fires in about 20,000 residential buildings over the 11-day period. The Hamburg Fire Department units, on the other hand, performed more or less continuously over the 11-day period with a continuously decreasing efficiency; its units either extinguished fires or prevented the spread of fires at about 4,300 fire sites. Water volume use rates by the Fire Department units was found to increase with fire fighting effort (i.e., in man-hours) to the 3/2 power.

The major constraint in deploying the fire fighting units to fire sites, according to the reports, was debris in the streets. Once at a fire site, the most-often mentioned difficulties were those of supplying water, the heat and spark showers and smoke, and of maintaining the hose lines. The main difficulties faced by the district headquarters were in locating the major fire areas as rapidly as possible and in finding out the whereabouts of the fire fighting squads who, without communications assigned themselves to fire sites (as per directive).

The reports indicate that no person in the bunkers died from fire effects, as had been reported previously. No specific survival rate data for either shelter or fire conditions are given in the Hamburg Fire Department documents. Outside survival within the fire areas appeared to be possible for an extended period only when the radius of the open area was 75 meters or more. In the extreme case, escape from the fire storm area by crawling on the street near the curb appeared to be feasible where the streets were at least 8 meters wide (curb-to-curb) and when safety could be reached in about 15 minutes.

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* These appendices are to be published separately.

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INTRODUCTION

Previous investigations relating to the subjects discussed in this report include the review and selection for copy of the documentation available in the Hamburg Fire Department files[1] and the translation and publication of selected portions of the collected records.[2, 3, 4] The latter referenced material consists only of the reproduction of summaries of reports and special information that were organized at the direction of the Hamburg Police President shortly after the large-scale air raids on Hamburg in late 1943.

A considerable number of the Hamburg Fire Department operational records covering the whole period of World War II air attacks were copied[1] and a number of these documents have been translated.[5, 6] These documents generally include detailed accounts of the activities of each brigade and squad of the Hamburg Fire Department (and other fire fighting groups) during and after each air attack, the numbers and locations of fires, successes and failures in putting out fires, manpower and equipment employed, time spent in fire fighting, difficulties encountered and operational constraints, organizational problems, communications and equipment failures, and how they were remedied (if at all), and personal experience accounts of events that took place within the fire regions.

Much information on these subjects is included in the main report of the Hamburg Police President Kehrl on the experiences suffered during the large-scale raids on Hamburg in July and August 1943.[7] Both data and interpretation of events involving the fire fighting forces in Hamburg before, during, and after World War II are presented by the Hamburg Fire Chief Brunswig in his extensive report on the practical experiences of the fire protection[8] services in Germany. He especially discusses problems that arose as well as solutions to these problems that were evolved in the subjects of organization and structure of the services, the technology aspects of the fire fighting methods and equipment, and the tactics of fire fighting under a variety of attack or disaster fire situations.

The current follow-on investigation has involved the summary and analysis of the information given in the Hamburg Fire Department action reports with a view to the establishment of a very approximate operational model of the fire fighting actions that took place during World War II which could,

if successful, provide guidance in developing a parallel construct for fire fighting operational planning for the nuclear war case.

The objectives of the study were to:

1. Summarize and organize available information on the Hamburg Fire Department World War II organization, number of fires that were fought, the number extinguished, time spent on various activities, and manpower, equipment and supply use rates.

2. Summarize information pertaining to constraints on fire fighting and movement in the fire area (e.g., debris, heat, lack of water, lack of adequate guidance or leadership, etc.).

3. Summarize information pertaining to conditions and locations under which escape from the fire area was or was not possible.

4. Summarize information relating fire conditions, shelter type or characteristics, and survival in the fire area.

5. Summarize the more obvious implications of the above summaries on future civil defense planning and operational concepts.

To accomplish these tasks, documentation obtained from the Hamburg Fire Department and from other sources were examined. The documentation available from the Hamburg Fire Department includes a number of reports in which the overall status of the fire forces available to the city, their deployment and service during and after air raids are described. Reports of the various air defense sectors of the city in which the intra- and intersector deployment of sector fire fighting forces are described are also available. In addition, a number of reports that describe the experiences of individuals that survived the mass fires of July and August of 1943 were available. All these documents provide some insight into the manner in which the people of Hamburg and their fire and police organizations performed under stress of the bombings and the resulting large scale fires.

ORGANIZATION OF THE HAMBURG FIRE DEPARTMENT DURING WORLD WAR II

Administrative Sectors

The regular fire department of Hamburg was directed from four major administrative sections that were respectively responsible for fire fighting in the geographic areas of Hamburg that are shown in Figure 1. The principal residential areas were in the sections under the responsibility of Groups East and West; however, Sector VIII included a large number of residences. The sections under cognizance of Group Harbor, consisting of Air Defense Sectors A, B, and C, contained most of the industrial establishments as well as the wharfs, warehouses, and businesses related to the shipping industry.

The overall command of the fire department, the police department, and the air (or civil) defense forces was in the Air District Command XI-Police President headquarters. The structure of the organizations is given in Figure 2. At the brigade level, the fire fighting forces that existed in 1942 are also given for each group, sector, precinct, and subprecinct. The organization chart is subdivided further in Figure 3 in which a diagram of the fire police Sector III organization is presented. The light fire brigades (ℓLZ) were normally equipped with 2 LF 15 motor pumpers which were manned by 13 men, 1 officer and 1 noncommissioned officer. Light fire brigades were made up of two light fire squads (ℓLGr). The heavy fire brigades were equipped with 2 LF 25 motor pumpers and were staffed in the same manner as the light brigades. The major items of equipment carried on the LF 15 motorized pumper, on the LF 25 motorized pumper, on the mobile power ladder truck (Kℓ), and on the motorized hose carrier (SchℓW) are listed in Table 1. The decontamination brigades (EZ) were generally staffed by 4 officers and 17 men and made up of two squads (EGr). They normally had two personnel carriers and trailers available to them. The industrial fire brigades usually consisted of about 13 men, an officer and a noncommissioned officer and was made up of two squads. Two special vehicles and specialized equipment were available to these brigades for industrial fire fighting. Power ladders (Kℓ) were manned by two men and hose carriers (SchℓW) by four.

In addition to the regular fire service of Hamburg, requirements had been laid down before the outbreak of war on the establishment and staffing of local civil defense units. The local air raid warden was given the responsibility of shelter management, establishment of one or more fire watches in every building during an air raid, the enforcement of blackout regulations and other duties. Responsibility did not end with the warden; individual

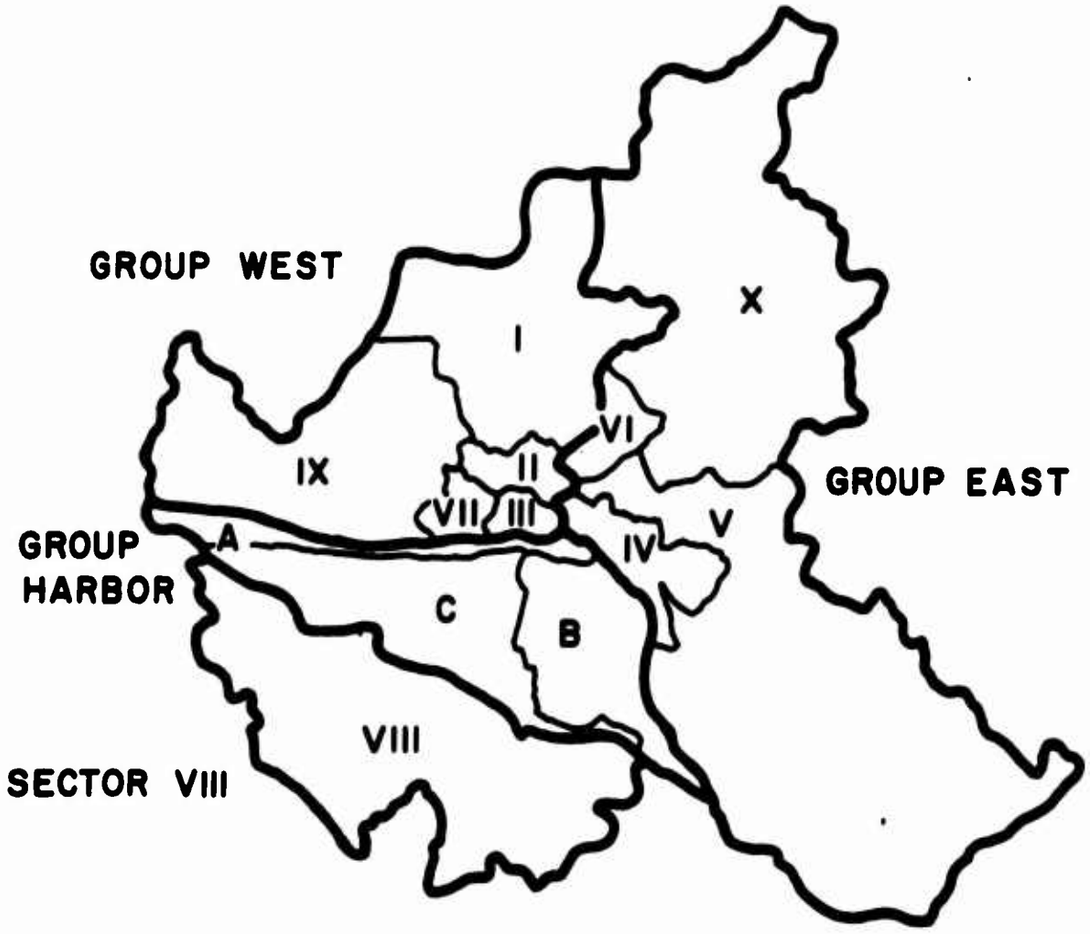

Figure 1: Hamburg Fire Department Administrative Areas and Sectors

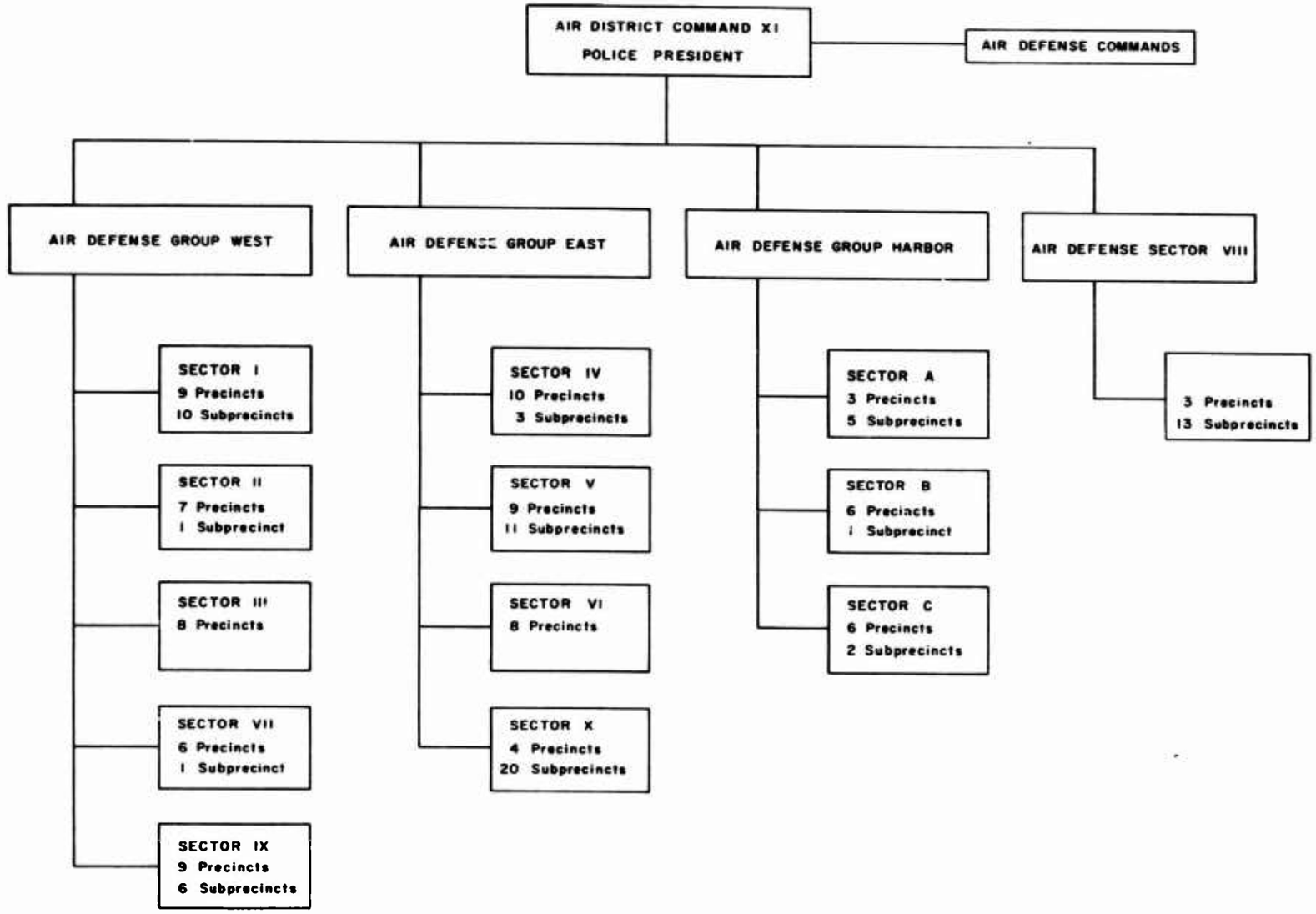

Figure 2: Simplified Organization Chart of the Hamburg Air Defense System (1942)

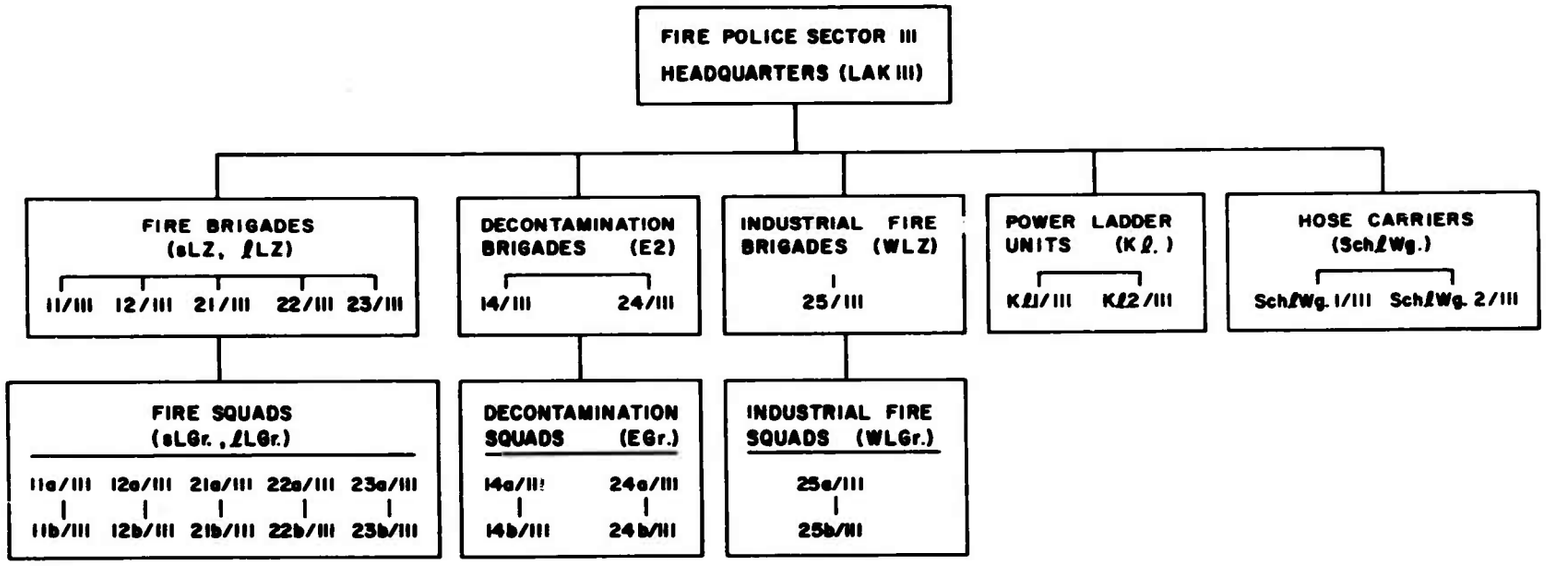

Figure 3: Composition of a Hamburg Fire-Police Department Sector or Division (1942)

Table 1

MAJOR EQUIPMENT CARRIED ON VARIOUS
GERMAN FIRE DEPARTMENT VEHICLES
DURING WORLD WAR II OPERATIONS

Equipment	Motor Pumper LF 15	Motor Pumper LF 25	Power Ladder	Hose Carrier
B Hose (20 m lengths)*	10	10	3	60
B Hose (3 m lengths)	2	2		
C Hose (15 m lengths)*	25	25	2	19
A Hose (2.5 m lengths)*	4	6		6
A Hose Couplings				5
B Hose Couplings				20
C Hose Couplings				5
B Standpipe	2	2	1	1
C Standpipe			1	
B Handpipe	2	3		3
C Handpipe		4		1
Hand Fire Extinguisher (powder)	1	1	1	
Hand Fire Extinguisher (water)	1	1	1	
Emergency Handpump		1	1	
Foam Apparatus	1	1		1
Distributor Manifold				2
Field Telephone				1
Knapsack Respirator	3	3		
Collapsible Stretcher		1	2	
Surgeon's Outfit		1	1	
First Aid Kit		1		
Oxygen Respirator Outfit		1		
Ladder Parts		4		
Divided Ladders		3		
Towing Cable (10 m long, 16 mm o.d.)			1	
Bicycle			1	
Searchlight with 27 m cable		1		2
5-Ton Jack			1	

Table 1 (Continued)

Equipment	Motor Pumper LF 15	Motor Pumper LF 25	Power Ladder	Hose Carrier
Megaphone			1	
Block and Tackle			1	
High Pressure Safety Valve				4
Rubber Suits	10	10		
Tools (set)	1	1	2	1
Spare Parts (assorted set)	1	1	1	1
Hose Repair Kit				1

* A Hose was 110 mm in diameter (suction or pressure hose)
B Hose was 75 mm in diameter
C Hose was 52 mm in diameter

and group responsibility of home, building owners, and dwellers to provide protection for themselves and their property was established; the civil defense regulations provided for the organization of these citizens' fire fighting groups called the "Selbstschutz," based on the self-security or self-protection principle.

The Self-Protection Service (Selbstschutz)

Assigned personnel of the service, consisting of one or more men (and at times, women), were required to stand fire watches in every structure not protected by another organization (such as an industrial air protection unit). They were instructed to extinguish fires and fire bombs immediately upon their discovery. Sand and water, shovels and light fire extinguishers placed in attics and at other convenient locations by the service or building owners were the principal items available to the service forces in extinguishing fires. Throughout the war the predominant type of incendiary bomb in terms of the numbers dropped in the attacks on Hamburg and other cities, was the British "Novobax" thermite bomb. These were rather light (1.7 kg of thermite) and could be removed or extinguished with light equipment. As a consequence, the Self-Protection Service performed very effectively during all except the heavier air raids. Under the regulations existing during the war, the number of persons assigned to the Self-Protection Service prior to the raids of July and August 1943 was about 122,000.

The Expanded Self-Protection Service (Erweiterter Selbstschutz)

The units in the Expanded Self-Protection Service were formed to protect buildings and structures of a public or semi-public nature (such as theaters, large apartment houses, etc.). Their purpose and mode of operation was the same as for the Self-Protection Service. In 1943, the Expanded Self-Protection Service in Hamburg consisted of 316 groups or squads, with ar average squad size of 7 men. They were better equipped than the Self-Protection Service groups and, in addition to sand, water and tools, were equipped with:

- one 400 or 800 liter/min nozzle
- 100 meters of B hose
- 150 meters of C hose
- 6 meters of A hose
- 1 standpipe and
- 2 C pipes

Thus they were able to fight and extinguish larger and more advanced fires than could the Self-Protection Service forces.

The Industrial Air Protection Service (Werkluftschutz)

This organization was established at the beginning of the war and its groups were made up of workers who were obliged to serve as fire protection personnel at their places of work during air raids. The number of men in each unit or squad varied according to the size of the building and the type of industrial activity carried out on the premises, but generally averaged about 7 men. In 1942, there were 178 industrial fire fighting squads in Hamburg. They were often specially equipped, but generally had available to them the same equipment as the Expanded Self-Protection units or:

- one 400 or 800 liter/min nozzle
- 100 meters of B hose
- 150 meters of C hose
- 6 meters of A hose
- 1 standpipe and
- 2 C pipes

The Nazi Party (N.S.D.A.P.)

Local party groups were organized into fire units to serve local areas. They, in general, were not established to operate in any given locality and could move more or less freely from one fire site to another. There were 165 local party fire fighting squads in Hamburg, each consisting of about 7 men. They usually had the same type and amount of equipment as the Expanded Self-Protection forces and the Industrial Air Protection forces, which included:

- one 400 or 800 liter/min nozzle
- 100 meters of B hose
- 150 meters of C hose
- 6 meters of A hose
- 1 standpipe and
- 2 C pipes

The Special Service Units (Besondere Verwaltung)

These units, formed of men from the Federal Government Special Services, averaged about 7 men per squad. There were 45 fire squads from the Special Services existing in Hamburg in 1943. They were not disposed at any given position during air raids and were often reported as not appearing at the scenes of fires. They generally served as fire details in buildings and structures related to their work (post offices, railroad yards, etc.). Each squad was equipped with:

- one 400 or 800 liter/min nozzle
- 100 meters of B hose
- 150 meters of C hose
- 6 meters of A hose
- 1 standpipe
- 2 C pipes

The Express or Rapid Response Units (Schnellkommandos)

As fire became a more important factor in the air war, the Express (or Rapid Response) Units were formed in January of 1941. They were given the task of providing "fast and intensive fire fighting (of fires resulting from incendiary bombs) during the early stages of fire development." These motorized units, by their early deployment and their vigorous methods, presumably had the task of limiting the size of fires. Other groups usually took over from them quickly after a fire was subdued. At first these squads were provided only a limited amount of equipment, including light fire fighting tools. The Express Units were under the authority of the security police and the usual complement of a squad consisted of:

- 2 police officers
- 3 security and first aid men
- 6 Hitler youths

They were transported by heavy personnel carriers; by March 1943, they were usually equipped with:

- 120 meters of C hose
- 1 standpipe
- 1 B to C manifold

The Express Units became actively engaged in fire fighting operations early in 1942, but from the number of fires that they extinguished they could not be considered to be a decisive factor in the fire control capabilities of the city of Hamburg.

The Express Aid Units (Sofortkommandos)

The Express Aid Units were established to provide rapid rescue and aid to persons hurt or trapped during an air raid and to transport such persons to hospitals or aid stations. They normally were equipped with 3 vehicles and a staff which consisted of:

- 1 repair squad (1 officer/8 men)
- 1 sanitary group with one doctor
- 1 police squad (1 officer/4 men)

Volunteer Fire Fighting Units (Freiwillige Feuerwehr)

The volunteer fire units readily available to the city of Hamburg from surrounding small towns and cities ranged from several well-equipped and well staffed units to units with non-standard equipment and poorly trained men. The forces that were readily available and their disposition (as support to Groups West, Group East, and Group South, including Group Harbor and Sector VIII) are given in Table 2. The strengths of most of these units are estimated. According to available reports by professional fire fighting personnel, the volunteer fire fighting units generally performed rather poorly at fires.

Fireboats (Löschboote)

During peacetime the fire department of the Port of Hamburg normally had 5 fireboats attached to it. After the outbreak of the war, many auxilliary units were brought into service. Since quite extensive areas of the city could be reached by fireboats on the rivers and by canals, they served usefully during raids of moderate intensity. In the larger attacks, however, their mobility in the city was cut down considerably by collapsed bridges or the blockage of canals and rivers by all kinds of debris. The fireboats available to Hamburg, their staffing, equipment, and pumping capacities are given in Table 3.

Other Available Outside Fire Fighting Units

Assistance in fighting major fires could be, and was, obtained by the commandant of Air District Command XI. Several fire regiments had been formed beginning in early 1940 under the command of the Schutzstaffel (SS). These were available only in cases of dire need. The fire regiment "Sachsen" was deployed in Hamburg during the July and August raids of 1943. This specialized fire fighting organization (as others) consisted of 3 motorized companies and each company had a complement of 130 men with 37 vehicles. The fire regiments were very effective fire fighting organizations and were well trained, staffed and equipped. Through some quirk of Nazi officialdom, the officers and men of these regiments were administratively transferred into the Armed-SS (Waffen-SS) in February of 1945, and renamed "The SS-Fire Security Regiments (motorized)." They were tattooed with the twin lightning strokes of the SS and their blood type. Inasmuch as the Waffen-SS was looked upon with considerable dislike by the advancing allied troops, the fate of many German firemen upon capture was the same as that of members of the regular Waffen-SS.

Table 2

IDENTIFIED VOLUNTEER FIRE FORCES

HAMBURG (7/26/42)

Group West			Group East			Group South		
Unit	Name	O/M	Unit	Name	O/M	Unit	Name	O/M
1	Seestermuhe	(1/8)*	9	Bad Oldesloe	(1/8)*	26	Buxtehude	1/8
2	Nevendeich	(1/8)	10	Ahrensburg	(1/8)	27	York	1/10
3	Garstedt	(1/8)	11	Hoisbuttel	(1/8)	28	Stade	1/8
4	Quickborn	(1/8)	12	Glashutte	(1/8)	29	Winsen	1/6
5	Hemdingen	(1/8)	13	Wilstedt	(1/8)	30	Hanstedt	1/9
6	Rellingen	(1/8)	14	Trittau	(1/8)	31	Hittfeld	1/8
7	Moorrege	(1/8)	15	Lutjensee	(1/8)	32	Hollenstedt	1/8
8	Halstenbek	(1/8)	16	Wulfsfelde	(1/8)	33	Luhdorf	1/4
			17	Harkscheide		34	Tostedt	1/8
			18	Grossensee		35	Kisdorf	(1/8)*
			19	Wentorf		36	Henstedt	(1/8)
			20	Geesthacht		37	Kaltenkirchen	(1/8)
			21	Lutau		38	Gluckstadt	(1/8)
			22	Lavenburg				
			23	Schwarzenback				
			24	Dassendorf				
			25	Reinbeck				
			25a	Strandfeld				
			25b	Ost Steinbeck				
			25c	Ratzeburg				

Estimated Total Personnel: 41 officers and 325 men

*Parentheses indicate estimated values. The listed units are all from outlying cities and towns and suburban areas.

Table 3

DESCRIPTION OF FIREBOATS

Name	Type	Pumping Capacity Liters/Minute	Nozzle Sizes in mm	Officers and Firemen	Hose Lengths Carried A	B	C
Fireboat I	Regular*	1000	22-35	20	4	15	15
Fireboat II	"	4000	22-35	20	4	15	15
Fireboat III	"	3000	22-35	20	4	15	15
Fireboat IV	"	2000-4000	22-35	20	4	20	20
Fireboat VI	"	12,000	22-35	20	4	20	20
Ruths	Auxiliary+	3000	25-45	4	0	10	10
Perthes	"	2000	25-45	3	0	10	10
Lichtwark	"	3000	25-45	4	0	10	10
Westphalen	"	2000	25-45	3	0	10	10
Eife	"	2000	25-45	3	0	10	10
Jenisch	"	2000	25-45	3	0	10	10
Heinecke	"	2000	25-45	3	0	10	10
Buchheister	"	2000	25-45	4	0	10	10
Brunshausen	"	3000	25-45	4	0	10	10
Borches	"	2000	25-45	3	0	10	10
Stammann	"	3000	25-45	4	0	10	10
Schleiden	"	2000	25-45	3	0	10	-
Waldersen	"	2000	25-45	3	0	10	10
Alardus	"	3000	25-45	4	0	10	10
Sieveking	"	2000	25-45	3	0	10	10
Number 15	Auxiliary	1000	25-45	0	0	0	0

*Regular fireboats also carried: 1 hand fire extinguisher (dry), 1 hand fire extinguisher (water), 4 B-handpipes, 4 C-handpipes, 1 complete CO_2 outfit, 1 complete foam outfit, 1 water cannon with 10 different nozzles, 1 searchlight with cables, tools for various purposes.

+Auxiliary fireboats (Number 15 excepted) stored A-hoses at Arningstrasse. Carried: 2 C-handpipes, 2 B-handpipes, 1 water cannon with 45 mm nozzle and various tools and spare parts.

Summary of the Hamburg Fire Fighting Organizations

The main characteristics of the Hamburg fire fighting organization prior to the major air attacks of July and August of 1943 are as follows:

A. Regular Fire Department (under a unified command headquarters with air or civil defense and police units)

1. City geographically organized into three air defense groups (Groups East, West, and Harbor) and a special sector (Sector VIII)

2. Three Groups subdivided into 12 subgroups or sectors

3. City area further divided into 88 precincts

4. City area was further divided into 73 subprecincts

5. The department had more than 30 regular fire fighting brigades (as of 7/26/42)

   a. a regular brigade normally consisted of 13 men in 2 squads
   b. a regular brigade normally had 2 vehicles

6. The department had 28 decontamination brigades (as of 7/43)

   a. a decontamination brigade normally consisted of 17 men in 2 squads
   b. a decontamination brigade normally had 2 vehicles

7. The department had 11 industrial fire fighting brigades (as of 7/43)

   a. an industrial brigade normally consisted of 13 men in 2 squads
   b. an industrial brigade normally had 2 vehicles

8. The department had 27 motorized (power) ladder trucks (as of 7/43)

9. The department had 21 hose trucks (as of 7/43)

10. The department had 5 regular fire fighting boats

B. Auxiliary and Other Air Defense District Fire Fighting Units (organized prior to July 1943)

1. There were 178 industrial civil defense or air defense fire

fighting squads

2. There were 316 expanded self-protection squads

3. There were 165 Nazi party-member squads

4. There were 45 special service squads

5. There were 122, 000 self-protection service members

6. There were 41 Volunteer fire fighting brigades

7. There were 36 rapid response brigades

The reported availability and usage of the above-listed and other forces during the heavy air attacks on Hamburg in July and August 1943, is summarized in Table 4 as taken from the Hamburg Police President's summary report[2] on these attacks (also see Appendix 1 to the summary report[3]). The available numbers of brigades given in Table 4 appear to be somewhat lower than those given in the above summary for the number of brigades planned or organized. Also, some of the organizations listed above appear to be grouped in the summary of Table 4.

The total manpower of the Hamburg city fire department for the year 1943 has been reported as follows (number of brigades and squads are estimated with allowance for headquarters personnel):

Unit Type	Number of Men	Brigades	Squads
Regular	690	50	100
Reserve	25	2	4
Civil Defense	2280	150 - 165	300-330
Auxiliary	330	22	44
Total	3325	224 - 239	448-478

A total of 11, 850 firemen (officers and men) were reported to have participated in fighting fires in Hamburg during and after these attacks. This number of personnel would be the equivalent of 825 Hamburg city fire department brigades or 1650 Hamburg city fire department squads. Further details on the organization, men, and equipment of the Hamburg Fire Department during World War II are given by Chief Brunswig.[8]

Table 4

REPORTED AVAILABILITY OF FIRE FIGHTING FORCES FOR ASSIGNMENT DURING THE AIR ATTACKS OF 7/24/43 THROUGH 8/4/43 ON HAMBURG

	Date			
	7/24	7/27	7/29	8/2
Air (or Civil) Defense Hamburg				
Fire and Emergency Service Brigades	30	25	22	21
Water Borne Fire Service Brigades	18	16	15	15
(Reinforced) Volunteer Fire Fighting Squads	60	58	52	49
Rapid Response (Schnell-Koms) Squads	36	34	28	28
Decontamination Brigades	8	7	6	6
Repair Squads	18	16	14	14
Ambulance Crews	13	12	10	10
Civil Defense Sanitation Squads	72	65	58	56
Sea Damage Control Brigades	5	5	4	4
Air (or Civil) Defense District				
Armed Forces Fire Hose Squads	14	62	42	4
NSDAP Squads	93	55	31	11
Industrial Company Fire Hose Squads*	309	155	157	63
(Fed. Gov't.) Special Service Squads	10	5	6	4
TES Men	790	686	1136	390
Concentration Camp Inmates	-	450	450	450
Out-of-Town Forces				
Fire Protection Police Companies	4	6	3	3
Voluntary Fire Department Squads	140	150	140	60
Air (Civil) Defense Motorized Divisions	7	7	10	5
Fire and Emergency Service Brigades	19	22	23	4
Voluntary Fire and Emergency Service Brigades	13	24	25	7
TES Men	412	323	239	378
Federal Labor Service Personnel	305	633	771	841

* Probably ICD plus ESP that were available for deployment at fire sites.

OPERATIONAL CHARACTERISTICS OF THE HAMBURG FIRE DEPARTMENT UNITS

Water Usage and Fire Fighting Effort

The use of water by the Hamburg fire department in fighting the fires caused by air raids was seldom reported. Only the groups from Sectors III and VII reported on water usage in extinguishing fires and then only on a sporadic basis. The information on water usage from these sources is presented in Table 5 and is plotted on Figure 4. A considerable variation in water consumption (from hydrants) occurred from one fire to another even though the fires might be considered to be of comparable size by the descriptions provided. The most significant parameter on which the water use in fire suppression depended appeared to be the number of man-hours of fire fighting effort accumulated by the squads or brigades at the fire site. The line drawn in Figure 4 representing the dependence of the water used on fire fighting effort is defined by

$$V = 0.22\ (E)^{1.5} \qquad (1)$$

in which E is the effort in man-hours (per fire site) and V is the cubic meters of water used in extinguishing a fire.

After many, if not most of the attacks, the water supply to local hydrants could not be maintained because of damage to various parts of the distribution system. Hamburg, however, is located on a plain, has few hills, and the water table is very near ground surface. The water table is so high, in fact, that a number of areas within the city could not be provided with suitable below-ground shelters at a reasonable cost. Due to the availability of ground water and the access to river and canal water, motor-pumpers were most frequently used to deliver water from available static water sources or the rivers and canals within the city. In addition, water storage tanks were provided at many locations about the city. A list of the more important sources of water are listed in Table 6.

Fire Site Coverage and Relative Activity of the Self-Protection Forces

To derive information on the relative attendance of the Hamburg Fire Department Groups and the Self-Protection Forces and on the effort expended by the former in extinguishing fires or in preventing fire spread, operational data from the Fire Department Documents were tabulated and summarized. The individual records of the fire fighting squads were reorganized according to fire-site for Air Attack No. 1 (May 18, 1940)

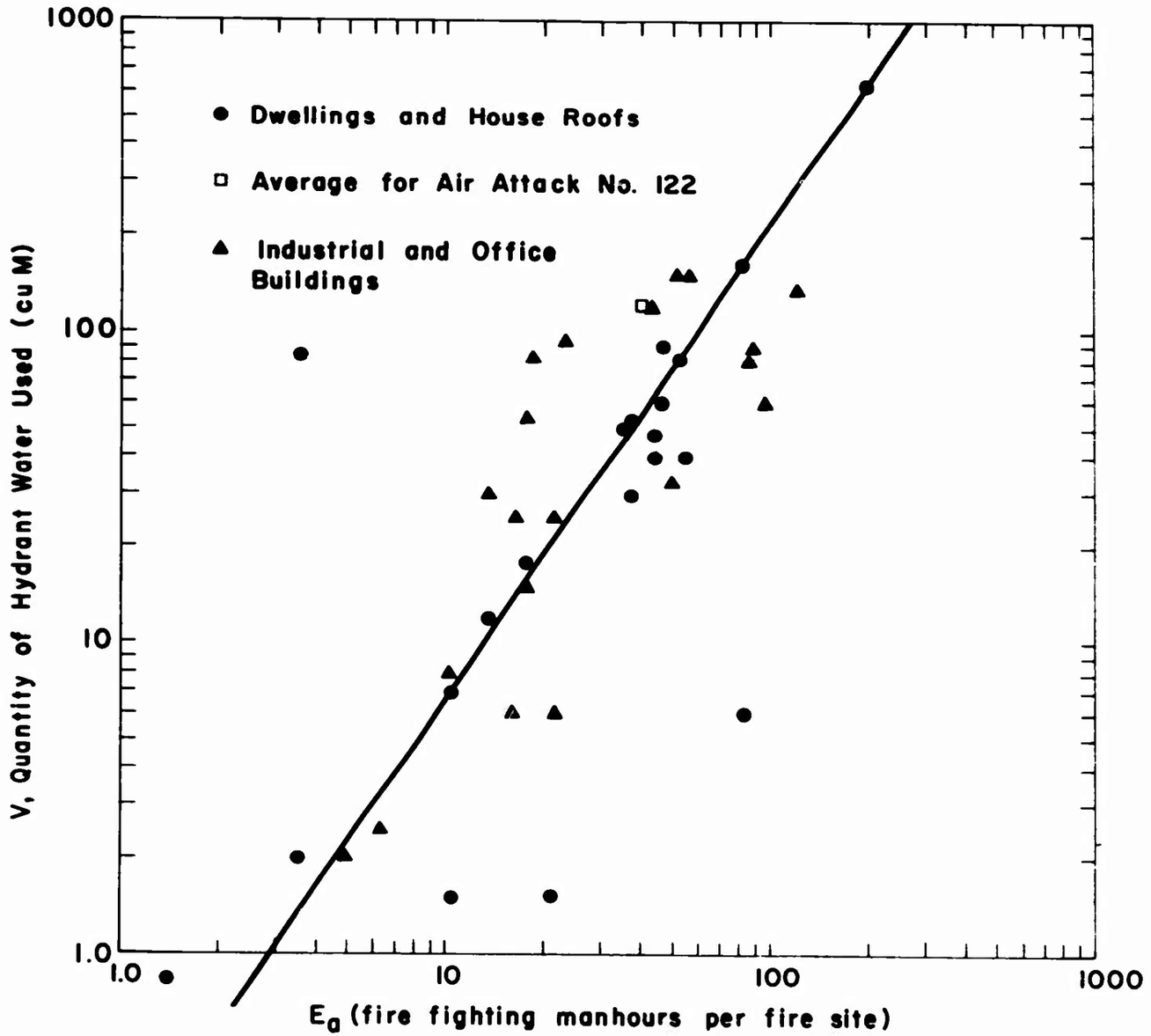

Figure 4: Hamburg Fire Department Hydrant Water Use During the Fighting of Air Raid Caused Fires

Table 5

REPORTED HYDRANT WATER USE
AND ESTIMATED FIRE FIGHTING EFFORT

Type of Fire	Unit	Time at Scene (Hours)	Effort (Man-hours)	Hoses in Use	Water Use (cu m)
Dwelling	21a/VII	6.5	45.5	3C	60
House Roof	21b/VII	5.3	37.1	1C	30
Containment (10 houses)	23a/VII	7.5	52.5	2C	81
Roof	11b/VII	0.5	3.5	1C	2
Top Stories, Shed	13a/VII	7.0	49.0	3C	33
Roof, Top Story	13b/VII	6.3	44.1	3C	48
Boat Supply, Auto Repair	13b/VII	2.5	17.5	3C	54
Several Roofs and Attics	12/VII	1.3	19.5	1B, 4C	36
" " " "	23/VII	5.1	76.5	4C	25
Dwelling	13a/VII	2.5	17.5	3C	18
Roof and Attic	21/VII	1.4	21.0	2C	1.5
Third Floor	12/VII	-	-	1C	1.5
Warehouse	13/III	4.7	70.5	4(?)	80.4
"	Kℓ/III	4.7	14.1	-	-
Coal Storage Shed	25a/III	0.7	4.9	1	2.0
Dwelling	12/III	5.5	82.5	5	6.0
Building	22/III	5.8	87.0	3	90
Roof	11b/VII	6.2	43.4	1B, 1C	120
Silo	13a/VII	5.7	39.9	4C	150
"	Kℓ/VII	5.1	15.3		
Roof	13b/VII	0.2	1.4	1C	0.8
Shop	13b/VII	1.1	7.7	1C	15
5 Story Silo	12a/VII	6.1	42.7	4C	100
"	12b/VII	6.1	42.7	-	-
"	14b/VII	5.0	35.0	-	36
4 Upper Stories	15/VII	6.2	93.0	5B, 3C	350
"	21/VII	7.1	106.5	2B, 2C	280
Second Floor	33a/VII	1.9	13.3	1C	30
Fish Smoking Shed	11a/VII	0.9	6.3	2C	2.5
Garage and Laboratory	22a/VII	2.6	18.2	5C	85
Several Houses	12a/VII	7.2	50.4	3C	150
" "	13a/VII	4.3	30.1	1C	10
Warehouse Dock	11a/VII	3.1	21.7	2C	5
Roof	22b/VII	1.9	13.3	-	12
Post Office	13b/VII	3.1	21.7	3C	25

Table 5 (Continued)

Type of Fire	Unit	Time at Scene (Hours)	Effort (Man-hours)	Hoses in Use	Water Use (cu m)
Thatched Roof House	21a/VII	0.5	3.5	1C	86
Boathouse	11b/VII	3.3	23.1	1B, 2C	96
Roof	23b/VII	1.5	10.5	1C	1.5
Roof	22a/VII	5.1	35.7	2C	50
Factory Roof	23a/VII	2.3	16.1	1C	6.0
Church and Parsonage	21a/VII	2.3	16.1	3C	25
Automobile Garage	21b/VII	1.5	10.5	1C	8.0
Dwelling	23b/VII	6.6	46.2	3C	90
Dwelling	14b/VII	7.8	54.6	5C	40
Dwelling Top Story	14a/VII	6.2	43.4	2C	40
Roof and Top Story	22b/VII	1.5	10.5	1C	7.0
Roof and Top Story	22b/VII	5.0	35.0	2C	50

Table 6

STATIC WATER SUPPLY OF HAMBURG*

- 152 water basins containing an average of 400 - 500 cubic meters each
- 20 water basins containing an average of 50 cubic meters each
- 5 wells for fire fighting delivering an average of 2.5 cubic meters per minute
- 355 wells for drinking purposes also, but delivery dependent upon available electric power
- 7 water basins in basements of destroyed buildings
- 35 ponds in gardens and parks
- 9 covered swimming pools
- 6 open air swimming pools
- 10 settling ponds
- 72 elevated tanks (usually in industrial areas)
- 5 overflow wells
- 45 dams on creeks
- 88 especially prepared platforms to allow motor pumpers to draw from rivers, lakes, etc.
- 5 pipelines for fire fighting purposes only, of 6 Km in length

*Within the vicinity of various rivers, viz. Elbe, Alster, Bille, which together with their branches reach into nearly all the Hamburg Districts, the static water supply was considered to be most satisfactory.

through the large Air Attack No. 122 (July 26, 1942). It was assumed that over the indicated period of time both the Fire Department personnel and the Self-Protection Service personnel would have gained experience in how to better cope with fires caused by the air raids. The Hamburg Fire Department records provide precise information on the times spent at fire sites; similar data were not reported for the Self-Protection Service squads. For the latter, only the number of action sites are given.

The data obtained from the documents are summarized in Table 7 in which the total fire fighting effort at all fire sites of a given type, the average effort per site, the number of each type of action site, and the percentage of attendance by different organizations at the fire sites are given for each air attack that produced at least one large fire.

The total effort and the total number of action sites generally increased with attack number (and time) but no general trend in the average effort per fire site is evident from the data in the table. The largest unit site efforts are for action types 3 and 4 (two or more houses on fire and industrial fires).

The data on the relative attendance at action sites show that the Self-Protection Service squads or groups were, on the average, in action at more fire sites than any other organization. This is partially a result of the fact that the predominant type of action site was a roof or attic fire in a residential building. The fractional number of action sites attended by the Fire Department Units and the Self-Protection Units are plotted as a function of the total number of fire sites for each attack in Figure 5. The data show that, up to about a 1000 fire sites, essentially all fires were fought by units of one of the two organizations (or from both) within the span of a few hours after attack. The low point for the Fire Department attendance (i.e., 0.17) after Air Attack No. 122 indicates that its capabilities were saturated when required to deploy at around 420 fire sites within a day or so following a large scale attack. On the other hand, the Air Attack No. 122 was not large enough to exceed the capabilities of the Self-Protection Service Forces to participate in a normal percentage of the fire fighting actions.

The mean values of the two ratios shown in Figure 5 give

$$n_{FD} = 0.38\, N_F \quad , \quad N_F \leq 1100 \tag{1}$$

$$n_{FD}(\max) = 420 \quad , \quad N_F > 1100 \tag{2}$$

and

$$n_{SP} = 0.59\, N_F \quad , \quad N_F \leq 2500 \text{ (or greater)} \tag{3}$$

Table 7

SUMMARY OF FIRE FIGHTING EFFORT IN HAMBURG
FOLLOWING AIR ATTACKS 1 THROUGH 122 (5/18/40 to 7/27/42)

Attack Number	Total Effort (man-hours)					Unit Site Effort (m hr/site)					Number of Action Sites						Percent of Action Sites							
	Type of Action Site					Type of Action Site					Type of Action Site						Organization							
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	Total	A	B	C	D	E	F	G	H
1	35	3.5	-	710	-	4.9	3.5	-	142	-	25	1	0	5	0	31	39	57	0	0	3			
3	2.2	-	-	98	-	2.2	-	-	98	-	3	0	0	1	0	4	50	50	0	0	0			
5	-	-	-	159	7	-	-	-	32	7	6	0	0	5	1	12	50	50	0	0	8			
7	7.0	-	-	-	-	3.5	-	-	-	-	5	0	0	0	0	5	40	60	0	0	0			
8	58	-	-	-	-	6.4	-	-	-	-	23	0	0	0	0	23	39	61	0	0	0			
17	-	-	-	-	32	-	-	-	-	32	1	0	0	0	0	1	100	0	0	0	0			
18	-	-	283	159	-	-	-	283	80	-	0	0	1	3	0	4	75	0	0	0	25			
20	38	-	-	-	-	4.3	-	-	-	-	34	0	0	0	1	35	29	71	0	0	0			
26	65	-	-	-	-	65	-	-	-	-	1	0	0	0	1	2	100	0	0	0	0			
30	-	-	-	64	-	-	-	-	32	-	3	0	0	3	0	6	33	50	0	0	17			
32	-	-	-	11	-	-	-	-	11	-	0	0	0	1	0	1	100	0	0	0	0			
37	8	-	-	-	-	8	-	-	-	-	7	0	0	0	0	7	14	86	0	0	0			
38/39	46	-	-	-	-	15	-	-	-	-	3	0	0	0	0	3	100	0	0	0	0			
41	-	36	24	8.2	-	-	36	24	8.2	-	3	0	0	0	0	3	100	0	0	0	0			
42	3.5	-	-	3.5	-	3.5	-	-	3.5	-	4	0	0	1	0	5	40	60	0	0	0			
48/49	11	-	-	87	-	3.8	-	-	87	-	13	0	0	1	0	14	29	71	0	0	0			
54	8.2	-	-	-	-	8.2	-	-	-	-	2	0	0	0	0	2	50	50	0	0	0			
56	79	16	-	224	52	20	8.3	-	56	26	23	2	0	5	2	32	41	59	0	0	9			
57	30	136	-	227	-	10	68	-	114	-	15	2	0	2	0	19	37	68	0	0	0	7		
63	5.0	43	178	625	2.7	5.0	43	30	208	2.7	21	1	2	3	1	28	29	71	0	0	0	0		
64	61	29	109	38	-	8.7	29	22	19	-	16	1	1	2	0	20	55	55	0	0	0	0		
65/66	437	70	242	177	60	17	17	24	59	10	166	4	10	3	6	189	25	75	0	0	0	0		
67	21	-	-	250	32	10	-	-	125	16	9	0	0	2	2	13	46	54	0	0	0	0		
68	13	38	-	-	-	6.6	38	-	-	-	2	1	0	0	0	3	100	0	0	0	0	0	33	
73/74	398	562	288	2828	117	10	70	144	66	6.9	176	8	2	43	17	246	37	56	0	0	7	0	0	
75	900	645	1439	199	124	12	72	180	14	9.5	269	9	8	15	13	314	37	59	4	0	0.3	0	0	

Table 7 (Continued)

Attack Number	Total Effort (man-hours) Type of Action Site					Unit Site Effort (m hr/site) Type of Action Site					Number of Action Sites Type of Action Site						Percent of Action Sites Organization							
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	Total	A	B	C	D	E	F	G	H
80	142	-	36	307	-	2.7	-	18	34	-	53	0	1	9	0	63	40	57	3	0	0	0	0	
82	396	162	-	3763	53	12	41	-	74	7.5	121	4	0	54	7	186	52	41	5	0	1.6	0.5	0	
83	1171	557	1416	3014	33	20	93	283	108	5.5	178	6	5	31	6	226	46	38	14	0	0.5	1.0	0	0.5
84	791	284	52	725	1.6	16	57	52	52	1.6	149	5	1	16	1	172	41	47	11	0	0.6	0.6	0	0
89	-	-	-	1289	-	-	-	-	644	-	22	0	0	2	0	24	8	86	4	0	0	0	0	0
94	-	-	-	34	-	-	-	-	34	-	13	0	0	1	0	14	29	71	0	0	0	0	0	0
95	-	-	-	488	-	-	-	-	488	-	23	0	0	1	0	24	42	58	0	0	0	0	0	0
102	133	267	-	789	305	9.6	89	-	113	61	79	3	0	7	5	94	31	66	3	0	0	0	2	2
105	181	88	281	-	5.0	36	88	281	-	5.0	14	1	1	0	1	17	47	53	0	0	0	0	0	0
109	84	15	-	161	27	9.3	15	-	40	4.5	28	1	0	4	6	39	51	49	0	0	0	0	0	0
111	1.5	-	-	581	20	1.5	-	-	581	5.1	1	0	0	1	4	6	100	17	0	0	0	0	0	0
112	162	330	354	18	485	8.1	165	177	4.6	30	107	2	2	4	16	131	34	60	6	0	0	0	0	0
113	85	128	-	616	-	17	64	-	308	-	18	2	0	2	0	22	41	45	14	0	0	0	0	0
115	-	-	206	232	-	-	-	206	232	-	8	0	1	1	0	10	20	80	0	0	0	0	0	0
119	165	299	1017	1049	93	18	43	113	70	19	48	7	9	20	5	89	51	39	3	1	4	1	0	1
120	1643	852	1604	2372	136	23	66	146	91	19	326	13	13	33	7	392	33	62	2	0.3	1.5	0.3	0.8	0
122	4274	5495	4454	6932	270	18	48	91	60	30	2146	115	49	139	9	2458	17	74	1	0.04	0.7	0.2	5	2

Type of Action Site

1 - Roof and/or attic fire
2 - Entire house on fire
3 - Two or more houses on fire
4 - Industrial fire
5 - Service and/or rescue

Organization Performing

A - Fire Department
B - Selbstschutz or Self-Protection Service
C - Schnell-Kommandos or Rapid Response Squads
D - Nazi Party
E - Industrial Service
F - Expanded Selbstschutz or Expanded Self-Protection Service
G - Volunteer Fire Fighting Units
H - Armed Forces (Regiments)

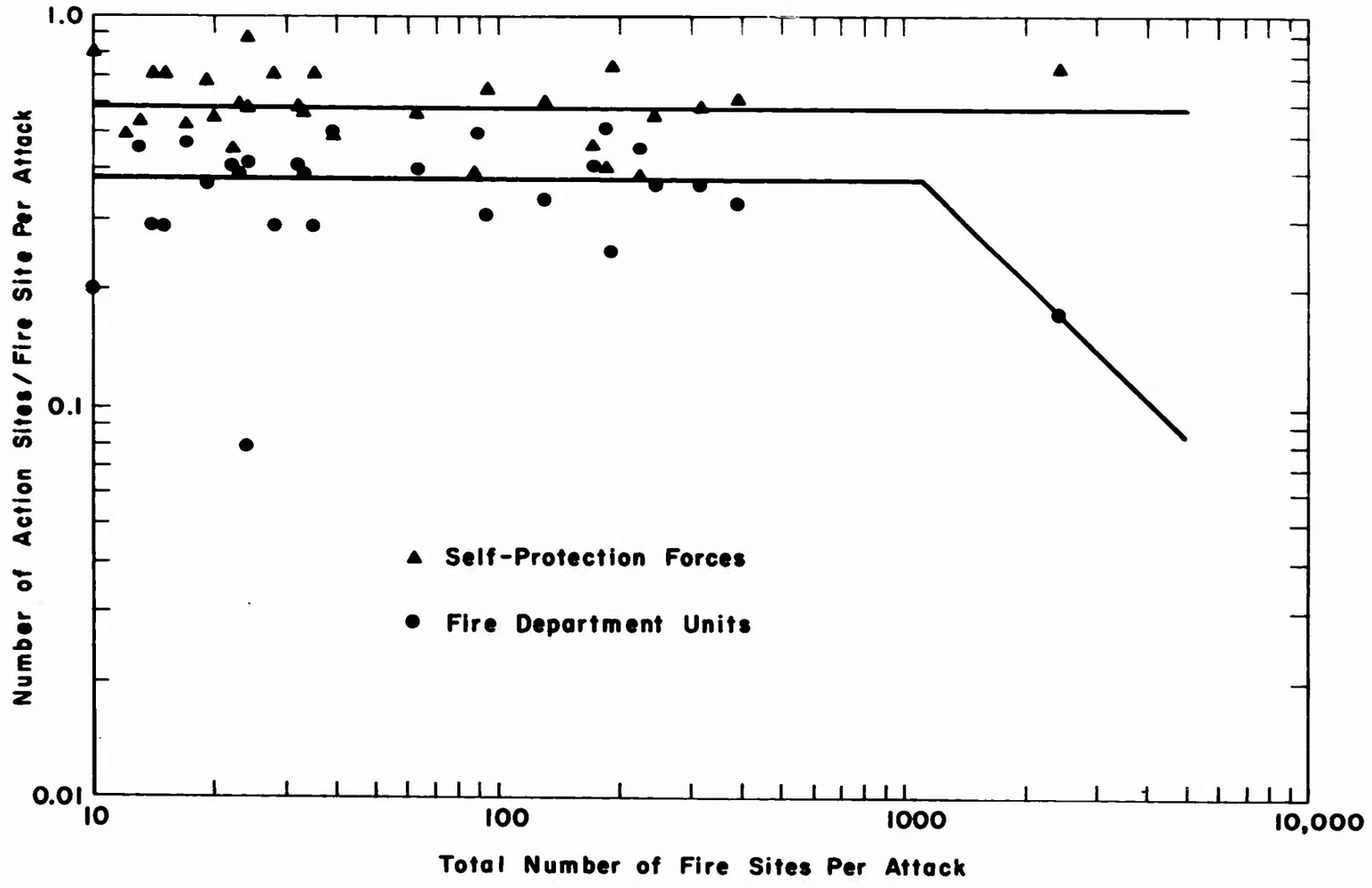

Figure 5: Variation of the Fractional Number of Fire Action Sites with the Total Number of Fire Sites for Single Air Attacks Attended by the Hamburg Fire Department Units and the Self-Protection Service Units

in which n_{FD} represents the number of action sites per attack for the Hamburg Fire Department, n_{SP} represents the number of action sites per attack for the Hamburg Self-Protection Service, and N_F is the number of air-raid-caused fire sites. The data thus shows that, for the fire fighting forces available up to mid-1942, the Self-Protection squads (on the average) fought 1.55 times more fires than did the Fire Department Units and, if the experience for Air Attack No. 122 were representative of attack levels causing 1000 to 10,000 fires, the expected relative number of fires fought would be given by

$$n_{SP}/n_{FD}(max) = 1.4 \times 10^{-3} N_F \qquad (4)$$

which, at N_F equal to 10,000 fires, would have a ratio value of 14 to 1. The relative and absolute usefulness of the Hamburg Self-Protection Service during the fighting of World War II air-attack-caused fires is discussed further later in this report.

Allowing for a total active strength of 96 squads for use in fire fighting following Air Attack No. 122, the average number of action sites per squad for that event would have been 4.38. Thus, if N_g is used to represent the number of available fire fighting squads, the maximum number of action sites per attack for the Hamburg Fire Department would be represented* by

$$n_{FD}(max) = 3.43\ N_g \qquad (5)$$

Even though no general trend in the average value of the fire fighting effort per fire site with time is readily apparent in the data of Table 7, a frequency distribution analysis of the unit site effort (E_a in man-hours per action site) was performed for all individual action sites for 4 time periods. The latter were: (1) 5/8/40 to 5/11/41; (2) 5/12/41 to 7/26/42; (3) 7/27/42 to 7/28/42; and (4) 5/8/40 to 7/28/42. The third case is for the single large attack on 7/27/42 to 7/28/42 which was the first to exceed the Fire Department's capabilities, as discussed above. The results of this analysis are summarized in Table 8 and the accumulated frequency distributions for each of the five types of fire fighting actions for the whole period, 5/8/40 to 7/28/42, are plotted in Figure 6. The distributions all appear to be logarithmic in nature.

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* 90 squads were deployed within an hour after the attack. It took another 4 hours to deploy an additional 96 requested squads at the various fire sites. Because of this delay only 1/3 of the latter were assumed to contribute to extinguishing fires at separate action sites and used to evaluate the coefficient of equation.

Table 8

SUMMARY OF THE HAMBURG FIRE DEPARTMENT ACTION SITE EFFORT DISTRIBUTIONS FOR VARIOUS TYPES OF ACTIONS AND TIME-PERIODS FROM 5/18/40 TO 7/28/42

Air Attack Numbers (Dates of Attacks)	Number of Action Sites	E_a Values (man-hours/action site) Percentage of Action Sites At Which E_a Was Less Than the Indicated Value									
		1	10	20	30	50	70	80	90	99	E_{max}
1. Residential Building Roof and Attic Fires											
Air Attack No. 1 to 83 (5/18/40-5/11/41)	320	1.1	2.4	3.2	4.1	7.0	14	20	34	95	200
Air Attack No. 84 to 121 (5/12/41-7/26/42)	152	<1.0	1.7	3.0	4.7	10	26	38	61	240	300
Air Attack No. 122 (7/27/42-7/28/42)	153	<1.0	2.9	4.5	8.5	18	38	52	73	127	200
Air Attack No. 1 to 122(5/18/40-7/28/42)	625	<1.0	2.3	3.4	4.7	9.1	20	31	52	290	300
2. Single Residence Entirely on Fire											
Air Attack No. 1 to 83 (5/18/40-5/11/41)	40	~3.2	5.2	10	24	41	76	115	160	300	300
Air Attack No. 84 to 121(5/12/41-7/26/42)	33	~4.2	10	18	26	4.9	83	108	163	300	300
Air Attack No. 122 (7/27/42-7/28/42)	87	~5.3	13	22	34	551	78	88	135	300	300
Air Attack No. 1 to 122(5/18/40-7/28/42)	160	~3.9	9.3	19	28	51	79	92	134	270	300
3. Several Residences on Fire											
Air Attack No. 1 to 83 (5/18/40-5/11/41)	30	~2.1	10	17	25	52	107	163	530	1,000	1,000
Air Attack No. 84 to 121(5/12/41-7/26/42)	23	10	23	42	63	125	247	375	600	600	600
Air Attack No. 122 (7/27/42-7/28/42)	45	10	31	48	66	90	122	147	190	400	400
Air Attack No. 1 to 122(5/18/40-7/28/42)	98	3.0	17	33	50	79	125	163	247	1,000	1,000
4. Industrial and Office Building Fires											
Air Attack No. 1 to 83 (5/18/40-5/11/41)	166	1.3	3.7	6.7	11	25	58	95	200	1,250	1,600
Air Attack No. 84 to 121(5/12/41-7/26/42)	81	<1.0	3.1	6.1	10	34	103	148	280	1,250	1,250
Air Attack No. 122 (7/27/42-7/28/42)	82	<1.0	3.8	8.8	16	36	62	87	210	1,000	1,000
Air Attack No. 1 to 122(5/18/40-7/28/42)	339	<1.0	3.5	6.9	10	29	67	110	216	1,060	1,600
5. Service and Rescue Operations											
Air Attack No. 1 to 83 (5/18/40-5/11/41)	59	~1.2	1.7	2.2	2.7	4.2	10	18	30	300	300
Air Attack No. 84 to 121 (5/12/41-7/26/42)	45	~1.3	1.8	2.5	3.3	7.0	21	40	77	300	300
Air Attack No. 122 (7/27/42-7/28/42)	9	~1.1	1.5	2.0	2.7	10	40	93	200	200	200
Air Attack No. 1 to 122 (5/13/40-7/28/42)	113	~1.2	1.7	2.3	2.9	5.0	13	24	47	290	300

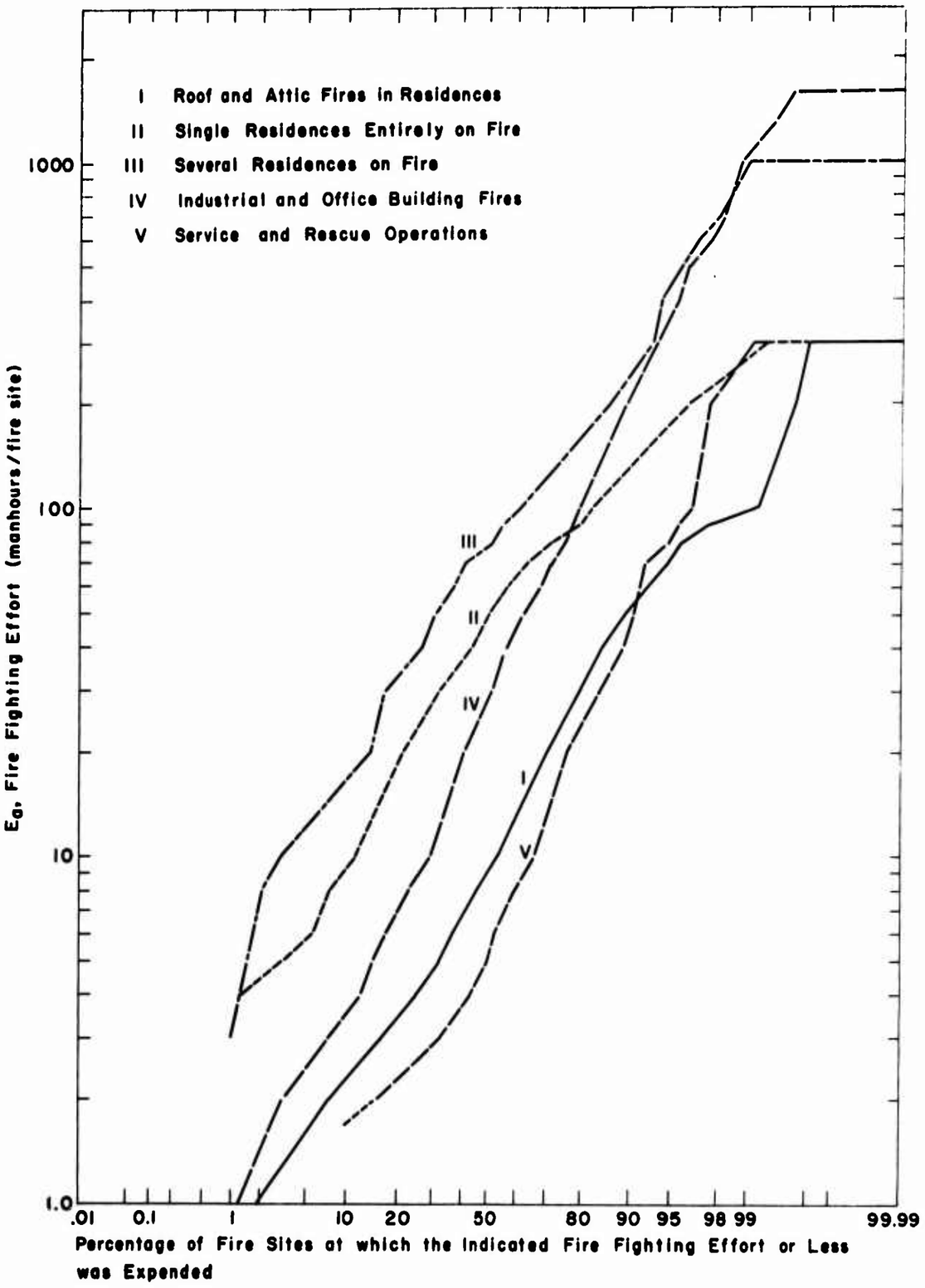

Figure 6: Frequency Distribution of the Fire Fighting Effort Per Fire Site for the Hamburg Fire Department Units in the Period 5/18/40 to 7/28/42

The time-spaced distributions show, somewhat unexpectedly, that the effort per action site (at the 50 percentile level) increased with time and experience. For four of the five action types, this trend carried on through the large scale Air Attack No. 122. This increase in effort per action site might be related to the general increase in size of the individual attacks and the increase in size and in types of bombs dropped. In any case where the fires would be further developed when the fire fighting unit arrived at the site, the longer it would take to depress or extinguish the fire. The possibility exists, of course, that the fire fighting units became more relaxed as they grew more accustomed to the air raid fire fighting routine.

On the average, the largest effort per action site was expended for actions involving fires on two or more residences (usually along one street); second largest effort per action site was for the single residence entirely on fire; the unit effort for industrial and office building fires was third largest; the unit effort for residential building roof and attic fires was fourth; and the least unit effort was expended on service and rescue operations. The rather extremely large range in E_a values for the industrial and office building fires (see curve IV in Figure 6) is due to the fact that small roof and shed fires were not separated out as they were for the residential building fires; the limiting value of E_a for very large fires requiring action types III and IV are, as expected, much larger than for the other action types.

The value of E_a for any given fire site should depend on how far the fire had developed, the size of structure or structures involved, the number of burning centers, and size of the assigned fire fighting unit. Thus the shape of distribution curves shown in Figure 4, especially with respect to the large range in values of E_a, probably reflect the range in various fire-sensitive characteristics of the buildings in the target area more than variations in effectiveness due to variations in fire fighting procedures and methods. It may be noted that the fire brigades classified a false alarm as a service operation and the number of these actions, which usually required a total of 1 to 3 man-hours of effort, amounted to 20 or 30 percent of the type V actions.

The data of Table 8 and Figure 6 are not to be associated with total fire fighting force requirements to put out fires but with the required concentration of forces at a given type of fire site. For example, at a site where a force is assembled that can expend 216 man-hours of fire fighting effort (on the average) over a span of a few hours, such effort should be sufficient to extinguish 90 out of 100 industrial and office building fires (reference Hamburg World War II buildings and fire fighting equipment). Alternately, for such a fire fighting force to be able to extinguish 90 out

of 100 industrial and office building fires to which it is deployed, it must be capable of concentrating sufficient forces so that it can expend 216 man-hours of effort at each site over a few hours of time, if needed.

Fire Fighting and the Large Scale Attacks of July and August 1943

The general aspects of these attacks have been widely reported, especially through the reports of the Hamburg Police President. The original copy of the President's report was translated by the United Kingdom Home Office, Civil Defense Department, Intelligence Branch and was issued as report No. 43097 in January 1946.[7] An abbreviated version of the report, which was located in the Hamburg Fire Department library among other Fire Department documents in 1965, is included in part as Appendix 1 to this report.

The reported data on the extent of damages to structures in Hamburg from the so-called terror air raids in the period, 7/25/43 to 8/4/43, are summarized in Table 9 by Air (or Civil) Defense Sector area. As is well-known, maximum relative damages occurred in Sectors IV and VI in the area of Group West where about 75 percent of the residential structures were destroyed and 72 to 78 percent of the industrial and office buildings were destroyed. Data summaries such as these for each of the four individual attacks apparently were not developed. Also, original detailed data on the activities of all the Fire Department units are not available since some of the records were destroyed during the raids. The reconstituted records appear to be incomplete; thus a detailed analysis of the fire fighting effort at all fire sites, as described above for the period 5/18/40 to 6/28/42, was not feasible. A partial analysis of the Fire Department operational data however, was performed; it is described below.

Averaged performance parameter values for the Hamburg Fire Department Units are summarized in Table 10, as taken from the Hamburg Police President's report (see Appendix 1). The Fire Department documents provide no summary of the level of activities of the Self-Protection Service effort except to say that the level was essentially non-existent after the attack of 7/25/43. On the other hand, the Police President's report provides the information summarized in Table 11 (with no reference to its source) in which these forces are attributed to saving 18,609 residential buildings. If this number is a valid statistic, then the relative degree of performance of the Self-Protection during these attacks was above the previous average, in spite of the criticism leveled by the professionals and in spite of the large loss of personnel through death and (forced and voluntary) evacuation after the first large attack. From the number of structures destroyed and moderately or severely damaged given by the data of Table 10, the number of fire sites in Hamburg over the period of

Table 9

SUMMARY OF THE RELATIVE AMOUNT OF DAMAGE TO STRUCTURES IN VARIOUS CIVIL DEFENSE SECTORS OF HAMBURG DURING THE PERIOD 7/25/43 TO 8/4/43

Sector	Residence Buildings (as of 7/24/43)	Population Residence Density (persons/ residence)	Residences After 8/4/43				Industrial and Office Buildings**	
			Destroyed (percent)*	Moderately to Severely Damaged (percent)*	Lightly Damaged (percent)*	Habitable (percent)*	Number on 7/24/43	Percent Destroyed
I	18,213	12.9	14.2	3.29	20.3	82.7	285	31.6
II	8,061	22.7	40.0	5.58	32.5	53.2	199	31.6
III	4,833	24.4	48.5	6.23	28.7	47.6	5,965	42.8
VII	7,349	22.9	43.4	4.45	18.8	50.3	428	28.3
IX	15,254	7.09	4.54	3.68	7.83	92.4	262	14.1
Area Group West	53,710	15.1	22.4	4.17	19.1	73.4	7,139	40.1
IV	7,627	25.6	75.8	1.68	0.88	22.0	1,209	77.7
V	16,785	13.8	42.8	1.63	8.69	54.7	389	59.4
VI	9,282	25.0	75.4	10.6	13.7	13.8	227	72.2
X	21,156	6.09	16.4	0.02	19.3	82.3	163	39.3
Area Group East	54,850	14.4	42.7	3.29	12.5	53.9	1,988	70.3
A	54	6.94	0.00	53.7	0.00	46.3	121	31.4
B	3,668	13.4	6.30	13.3	18.8	80.5	365	14.5
C	1,684	7.02	1.13	2.91	4.69	96.0	134	6.72
Area Group Harbor	5,406	11.4	4.62	10.5	14.2	85.0	620	
VIII	8,357	12.8	0.04	0.11	1.60	99.5	137	6.57
Area Hamburg+	122,323	14.5	29.2	3.78	14.8	67.0	9,884	44.2

*Percent of Residence Buildings reported for 7/24/43.

**Includes factories and large office or public administration buildings protected by the Industrial Civil Defense Groups, the Expanded Self-Protection Forces and Public Aministration Forces.

+Alternatively, it is reported that, not counting Harburg, 56.2 percent of 450,800 dwellings were destroyed and another 10.0 percent were damaged; or, of 556,760 housing units, 274,270 (49.3 percent) were destroyed.

Table 10

DISTRIBUTION OF FIRE FIGHTING UNIT ASSIGNMENT ACTIONS
FOR THE AIR ATTACKS OF 7/25/43 THROUGH 8/4/43 ON HAMBURG

1. Number per Assignment*

Type of Action	Action Period 7/25-7/27	7/28-7/29	7/30-8/2	8/3-8/4	7/25-8/4
Fires extinguished	0.428	0.395	0.321	0.341	0.380
Fires diminished in size	0.216	0.194	0.169	0.156	0.191
Fires prevented from spreading	0.106	0.077	0.112	0.095	0.100
Fires afterhosed	0.185	0.221	0.328	0.362	0.253
Rescue cases	0.017	0.058	0.006	0.008	0.023
Material salvage operations	0.024	0.025	0.035	-	0.024
Laying long hose lines	0.024	0.030	0.029	0.038	0.029

2. Number per Squad

	Action Period 7/25-7/27	7/28-7/29	7/30-8/2	8/3-8/4	7/25-8/4**
Total Assignments	7.03	4.94	6.56	3.03	5.51
Fires extinguished	3.01	1.95	2.10	1.04	2.10
Fires diminished in size	1.52	0.960	1.11	9.472	1.05
Fires prevented from spreading	0.746	0.379	0.735	0.287	0.548
Fire fighting action sites	5.28	3.29	3.95	1.80	3.58
Fires afterhosed	1.30	1.09	2.15	1.09	1.40
Rescue cases	0.123	0.289	0.0417	0.0236	0.125
Material salvage operations	0.167	0.124	0.227	-	0.133
Laying long hose lines	0.170	0.148	0.193	0.114	0.157

*Number of Assignments	2,404	1,473	1,731	769	6,377
Number of Squads	342	298	264	254	-

**Average per attack.

Table 11

SUMMARY OF BUILDINGS THAT WERE ENTIRELY OR PARTIALLY SAVED BY HAMBURG FORCES, WITH OR WITHOUT OUTSIDE ASSISTANCE*

Service	Residential & Other Bldgs. and Installations	Of These, the Following Were Ignited by Incendiary Bombs	Of These, the Following Were Ignited by Heat or Firebrands**
Self-Protection Service	18, 609	8, 593	10, 016
Expanded Self-Protection Service	1, 769	1, 380	389
Industrial Civil Defense Service	1, 835	1, 215	620
Special Administrative Service	307	250	57
Total	22, 520	11, 438	11, 082

*As far as it has been possible to ascertain, an additional 4, 853 houses were hit and saved from destruction by Hamburg fire fighting forces; however, these houses were destroyed by fire during subsequent attacks because of the lack of water to fight the fires.

**Of these houses, 2, 196 were later hit several times but saved from burning down.

of attack must have been between 40, 000 and 60, 000, if the heavily burned areas are not counted as a single site. These numbers of fire sites would give action site ratios of between 0.31 and 0.47 action sites per fire site for the Self-Protection Service forces.

Of the 6, 377 action assignments performed by the Fire and Emergency Service Units and allied groups, 67 percent, or 4, 280 actions, involved direct fire fighting operations during the critical periods. This number of action sites gives ratio values of 0.071 to 0.11 action sites per fire site for the Fire Department Units. (These values are higher than would be predicted from Equation 2 where only 420 x 4 or about 1700 action sites would have been estimated, not considering any change in size of the available forces for the respective cases.) The value of the ratio, n_{SP}/n_{FD}, for the reported action sites would be 4.35 which is larger than its value was for all previous attacks except for Air Attack No. 122 where its value was also 4.35. The relative performance of the professional and non-professional fire fighting forces need not be further belabored since neither had the capabilities to suppress the fires in the mass fire area once they were ignited at the stated density.

The overall success of the fire fighting operations by the Hamburg Fire Department is generally reported in their documents in terms of extinguishing a fire or in preventing its spread. Other tasks, as itemized in Table 10, are not summarized even though the bulk of the time of most of the squads was spent on other tasks. A representative set of tasks and the times spent at each for four Fire and Emergency Service Squads is given on a daily basis from 7/25/43 to 8/4/43 in Table 12. Some discrepancies exist wherein one squad reports the extinguishment of a fire the second day after an attack whereas another squad might report the extinguishment of a fire after noon of the attack day as an afterhosing operation. Also, in one case, the washing-down of fire-residues is called an afterhosing operation and on another the same type of task might be termed a clean-up operation (in most cases, however, the latter referred to debris clearance operations). In Table 12, the total time at the various reported assigned tasks represented about 50 percent of the total available time for the reporting period (e.g., the percentage for an average 8-hour work day would be 33%). The total working times for various squads from the Fire and Emergency Service Divisions I, III, and V are summarized in Table 13, according to the availability of the reported information.

Assuming that the performance of listed squads was about average for all, then about 45 percent of the available time of each squad, or 10.8 hours per day, was spent on assigned tasks and, of this time, 1.8 hours per day (17%) on the average was spent in preventing the spread of fires,

Table 12

SUMMARY OF TIME SPENT BY SQUADS 11a, 11b, 12a, and 12b OF DIVISION I ON VARIOUS ASSIGNED TASKS IN THE PERIOD 7/25/43 THROUGH 8/4/43

Date	Task X[a]	Task Y[b]	Task Z[c]	Hours	Date	Task X	Task Y	Task Z	Hours
		Squad 11a/I					Squad 11b/I		
7/25			1(factory)	5.17	7/25	2(shop)		1(res)	2.33
	1(res)[d]			6.58				2(res)	2.80
		afterhose		10.00		-(res)		-(res)	17.50
7/26		afterhose		7.00	7/26	4(res)		1(res)	13.75
7/27		afterhose		7.00			afterhose		8.00
		clean-up, pump water		10.00	7/27		clean-up		6.00
7/28			1(res)	10.30			clean-up, pump water		11.00
		refill basins		9.00	7/28			1(res)	10.30
7/29		clean-up		4.00	7/29		afterhose		6.00
7/30			1(res)	5.25	7/30	3(res)			5.25
		made rescue of 400 people possible		3.50			made rescue of 400 people possible		3.50
		refill basins		5.00	7/31		refill basins		4.00
7/31		refill basins		1.00			clean-up, refill basins		7.00
		clean-up, refill basins		7.00	8/1		clean-up		2.00
8/1		clean-up		2.00			clean-up		6.00
		refill basins		9.00	8/2		clean-up		5.00
8/2		clean-up		5.00			clean-up		3.00
		clean-up		8.00			clean-up		3.00
		refill basins		2.00			clean-up		4.00
8/3	2(villa, res)			9.50	8/3			2(res)	2.00
		afterhose		1.00		1(res)			2.67
8/4		afterhose, clean-up		2.00			afterhose		7.00
		afterhose, clean-up		6.00	8/4		afterhose		3.00
			Total	135.30 (51%)[e]				Total	135.10 (51%)

Table 12 (continued)

Date	Task X[a]	Task Y[b]	Task Z[c]	Hours	Date	Task X	Task Y	Task Z	Hours
	Squad 12a/I						Squad 12b/I		
7/25			2(res)	2.17	7/25			1(res)	0.92
	1(res)			4.08		2(res)		3(res)	10.58
	1(res)			4.33			afterhose		9.00
	3(res)		1(res)	8.75	7/26		afterhose		18.00
		clean-up		2.00	7/27		clean-up		12.00
7/26		clean-up		10.00	7/28	1(barracks)			4.08
	2	clean-up		2.17			afterhose		2.00
		refill basins		3.00	7/29		clean-up		4.00
7/27		afterhose		4.00			refill basins		10.00
		afterhose		5.00	7/30	2(res)			
7/28		afterhose		1.00		1(lumberyard)		1(school)	10.89
	1(res)		2(res)	4.25			clean-up		4.00
			1(office)	6.92			refill basins		2.00
		afterhose		4.50	7/31		refill basins		7.00
7/29		refill basins		12.00			refill basins		1.00
7/30	1(city hall)			11.90	8/1		refill basins		11.00
		afterhose		4.25	8/2		afterhose		3.00
			1(lumber-yard)	3.25	8/3	2(res)		2(res)	13.33
7/31		afterhose		14.00	8/4		afterhose		4.00
8/1		no action		-					
8/2		afterhose		9.25				Total	126.80 (48%)
8/3			1(res)	2.95					
			1(gallery)	2.00					
8/4		no report		-					
			Total	121.77 (51%)					

[a] Task X refers to preventing the spread of the fire(s)

[b] Task Y refers to miscellaneous assignments

[c] Task Z refers to extinguishing the fire(s)

[d] (res) for residential, etc.

[e] represents percent of total available time spent on assignments

Table 13

SUMMARY OF TIME SPENT BY SQUADS OF DIVISIONS I, III, AND V
ON DIFFERENT FIRE FIGHTING TASKS
IN THE PERIOD 7/25/43 THROUGH 8/4/43

Unit	Task X[a]	Task Y[b]	Task Z[c]	Total (% max)[d]
Squad 11a/I	16.08(12)[e]	98.50(73)[e]	20.72(15)[e]	135.30(51)
Squad 11b/I	34.48(26)	78.49(58)	22.13(16)	135.10(51)
Squad 12a/I	28.30(23)	71.15(58)	22.32(18)	121.77(51)
Squad 12b/I	32.14(25)	78.00(62)	16.66(13)	126.80(48)
Squad 13a/I	29.74(22)	59.03(44)	44.15(33)	132.92(55)
Squad 13b/I	33.66(33)	37.02(37)	29.82(30)	100.50(49)
Squad 14a/I	19.65(18)	76.33(69)	15.15(14)	111.13(42)
Squad 14b/I	24.54(24)	72.92(72)	4.04(4)	101.50(38)
Average	29.1 (23)	74.8 (59)	22.8 (18)	126.7 (48)
Squad 11a/III	25.54(26)	34.46(35)	39.70(39)	99.70(38)
Squad 11b/III	13.92(13)	44.33(43)	45.03(44)	103.28(39)
Squad 12a/III	24.00(22)	48.66(45)	35.00(33)	107.66(45)
Squad 12b/III	24.00(24)	56.88(57)	18.92(19)	99.80(46)
Squad 13a/III	38.82(32)	45.74(39)	35.22(29)	119.78(45)
Squad 13b/III	16.10(15)	45.21(42)	45.10(42)	106.41(40)
Squad 21a/III	20.50(24)	29.50(35)	35.00(41)	85.00(51)
Squad 21b/III	13.75(19)	34.42(47)	25.41(34)	73.58(44)
Squad 22a/III	32.11(29)	50.88(46)	28.36(25)	111.35(46)
Squad 22b/III	37.43(35)	46.00(43)	23.74(22)	107.17(45)
Squad 23a/III	36.51(31)	69.33(59)	12.34(10)	118.18(49)
Squad 23b/III	33.96(33)	56.49(55)	13.02(12)	103.47(54)
Squad 24a/III	19.00(26)	40.90(55)	14.25(19)	74.15(31)
Squad 24b/III	4.50(7)	35.50(55)	24.00(38)	64.00(30)
Average	27.2 (24)	53.4 (47)	32.9 (29)	113.5 (43)
Squad 11a/V	5.17(3)	113.65(73)	37.34(24)	156.16(59)
Squad 11b/V	-	117.09(78)	32.34(22)	149.43(57)
Squad 12a/V	22.53(26)	43.05(50)	20.74(24)	86.32(40)
Squad 12b/V	8.52(9)	58.62(59)	31.52(32)	98.66(46)
Squad 13a/V	14.51(10)	100.48(72)	24.01(18)	139.00(53)
Squad 13b/V	15.90(11)	100.50(73)	22.10(16)	138.50(52)
Squad 14a/V	6.67(10)	43.27(68)	13.75(22)	63.69(38)
Squad 14b/V	10.43(22)	30.75(63)	7.50(15)	48.68(41)

Table 13 (continued)

Unit	Task X[a]	Task Y[b]	Task Z[c]	Total (% max)[d]
Squad 21a/V	5.00(5)	42.25(46)	45.00(49)	92.25(40)
Squad 21b/V	17.20(27)	27.00(43)	18.80(30)	63.00(38)
Squad 22a/V	4.00(4)	62.75(62)	34.50(34)	101.25(42)
Squad 22b/V	-	55.25(6)	37.60(40)	92.85(43)
Squad 23a/V	2.85(3)	76.63(77)	19.86(20)	99.34(41)
Squad 23b/V	5.38(5)	66.16(63)	33.37(32)	104.91(44)
Squad 24a/V	4.00(4)	100,33(88)	9.00(8)	113.33(47)
Squad 24b/V	-	80.00(74)	28.17(26)	108.17(45)
Squad 31a/V	3.00(3)	38.42(45)	44.33(52)	85.75(51)
Squad 31b/V	28.58(36)	42.16(53)	8.56(11)	79.30(41)
Squad 32a/V	-	20.00(31)	44.50(69)	64.50(45)
Squad 32b/V	2.50(4)	24.50(36)	41.75(60)	68.75(36)
Squad 33a/V	11.10(16)	31.50(44)	28.70(40)	71.30(37)
Squad 33b/V	13.50(20)	27.50(42)	25.00(38)	66.00(39)
Squad 34a/V	6.00(8)	41.21(53)	30.84(39)	78.05(54)
Average	11.9 (10)	70.1 (59)	36.8 (31)	118.8 (45)
Overall Average	20.2 (17)	65.3 (55)	33.3 (28)	118.8 (45)

[a]Task X refers to preventing the spread of the fire(s).

[b]Task Y refers to miscellaneous assignments.

[c]Task Z refers to extinguishing the fire(s).

[d]Percent of maximum time available for assignment to tasks (e.g., for 11 days of reported activity, maximum time is 264 hours).

[e]Values in parentheses are percent of time spent on assignments.

3.0 hours per day (28%) on the average was spent in extinguishing fires, and 5.9 hours per day (55%) on the average was spent on other tasks (mainly afterhosing). These averages do not actually represent the situation for any one day since the tasks of extinguishing and preventing the spread of fires essentially all took place on the day after the attack and the other tasks took place mostly on following days.

The frequency distribution of the times that the 45 squads of the Hamburg Fire and Emergency Service spent in extinguishing fires and in preventing fire spread, as obtained from their reported activities is shown in Figure 7 for residential structures and the larger industrial and office buildings. The midrange or the 50 percentile values of the time spent on the designated tasks at the various action sites are, for the four cases:

I: 2.4 squad-hours/site (131 incidents; 17%)
II: 2.4 squad-hours/site (353 incidents; 47%)
III: 3.6 squad-hours/site (56 incidents; 8%)
IV: 2.2 squad-hours/site (215 incidents; 28%)

The manpower level-of-effort may be obtained by multiplying the times for the squad by 7.5 men/squad. However, the total fire fighting effort per fire site was not readily obtained because the mass of reported data was by squad rather than accumulated on the basis of fire sites. The data are useful, however, to illustrate for the stressed situation that existed, that 10 to 20 percent of the squad assignments were completed in less than an hour and that 10 percent of the tasks of type III required 10 hours of squad effort. Less than 2 percent of the assignments required a time-on-site longer than 15 hours.

The overall averages from the data used in Figure 7 for the number of action sites at which fires were extinguished (over the 11-day period) is 10.75 sites/squad and for those at which fire spread was prevented is 6.02 sites/squad. These averages, when combined with the average number of hours spent at the two types of tasks, as given in Table 13, give an average of 3.1 squad-hours/site for extinguishing fires and 3.4 squad-hours/site for preventing fire spread. The average values of these unit site times are higher than the 50 percentile values only because the longer time incidents are more heavily weighted in the average.

For an average fire fighting force of 290 squads (see Table 10), the average number of action sites per squad given in the above paragraph would yield an estimated 3,118 sites at which the fire was extinguished (for the 11-day period) and 1,746 sites at which fire spread was prevented. The total action sites for these 2 types of actions is then 4,864. Using the 50 percentile values of 2.4 squad-hours/site for extinguishing fires and 2.5

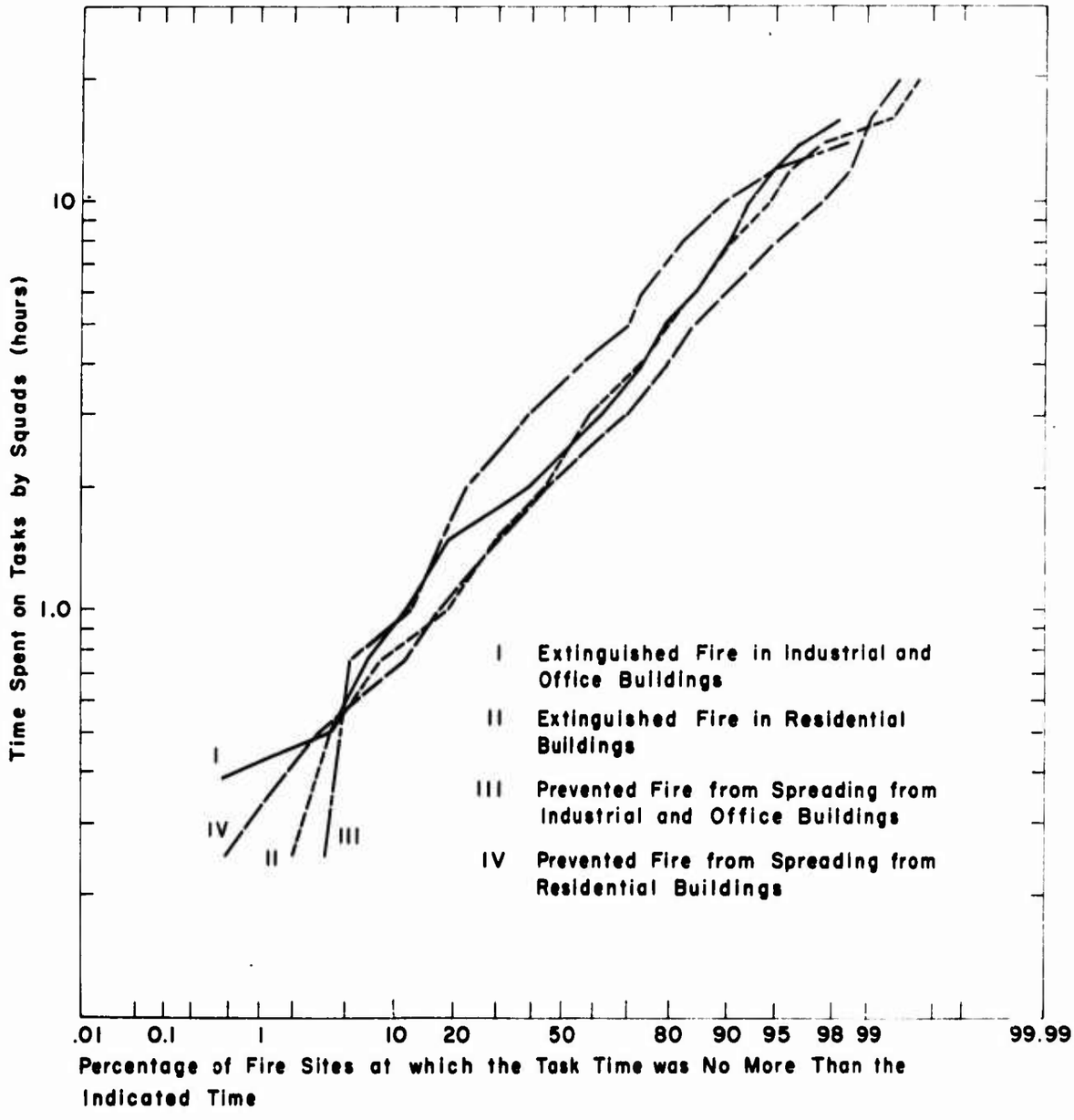

Figure 7: Frequency Distribution of the Time Spent by the Hamburg Fire and Emergency Service Squads on Tasks of Extinguishing Fires or of Preventing Fire Spread

squad-hours/site for preventing fire spread leads to 13.7 and 8.0 action sites/squad for extinguishing fires and preventing fire spread, respectively, and to a total estimated 6.293 action sites for 290 squads over the 11-day period. The average values of the number of action sites per squad give a total number of action sites that corresponds quite well with the 4,280 action sites obtained from Table 10 for the first three types of fire fighting actions. If the average values of the per squad action sites for the 11-day period are distributed by attack similar to that given in Table 10, the per-attack values are as follows:

Period	Fire Fighting Action Sites per Squad (per attack)	
	Table 10	Table 13 (averages)
7/25-7/27	5.28	7.08
7/28-7/29	3.29	3.84
7/30-8/2	3.95	4.08
8/3-8/4	1.80	1.78

At an average time of 3.2 squad-hours/site, the 7.08 action sites per squad given above would represent almost 23 hours of real time for each squad at fire sites. Since the represented actions were only counted when occurring within about 40 hours after attack (and often for a time period of less than 24 hours, as in Table 12), the squads actually spent more than 60 percent of the day of the first attack at fire sites. The high number for the action sites visited per squad for the first attack was due to the fact that many squads moved around to isolated fires and were not sent to the districts in which heavily damaged areas existed until some time after the attack was over. The debris had not yet built up in the streets to a prohibitive degree. In the second attack, most of the squads were on afterhosing and clean-up duty away from the area that was heavily attacked. In this case, the debris problem was severe, the squads had to take round-about routes to get near the main fire area and the area could not be entered when the squads arrived because of the heat and smoke as well as because of the debris in the streets. Also, the water supply problem was more severe than for the first attack. Thus the squads had to spend more time in going to a fire site or in moving from one to another and in laying hoses to water sources and had less time available for fighting the fires.

The estimated fuel consumption for the Hamburg Fire Department, together with an estimated total effort at all types of action sites of 34,450 squad-hours over the 11-day period, gives an average fuel consumption rate of about 1.24 gals of fuel per squad-hour (at action sites). This relative fuel consumption rate may be slightly high since some fuel was given to out-of-town units who ran out during their stay in Hamburg. Of the fuel

consumed, about 55% was gasoline and the remainder was dissel fuel. The consumption rate of oil is estimated at 0.12 quarts per squad-hour (at action sites).

If the majority of the 18,609 residential (and other) buildings saved by the Self-Protection forces represent actions during and after the first of the four heavy attacks, then the relative attendance of these forces would be approximately 2 action sites per squad. In mathematical form, this approximation is given by

$$n_{SP}(max) = 2N_{sg} \tag{6}$$

where N_{sg} represents the number of Self-Protection Service squads in an area that had received a more or less uniform density of damage. The 2 action sites per squad as a maximum for the Self-Protection Service forces would generally apply to the situation where the Fire Department units would attain a maximum of 5 to 7, or about 6 action sites per squad. By the fire fighting techniques and equipment available to them, the Self-Protection squads would probably have attended their maximum of 2 fire sites before the Fire Department squads completed action at their first site.

According to the above-discussed analysis of information on the Hamburg World War II fire fighting experience, the fraction of the fires that were extinguished and/or controlled by the combined forces of the Self-Protection Service and the Fire and Emergency Service was independent of the number of fires started in an air raid until the number of fires exceeded a given stated number whose value depends on the number of squads available for duty at the time. For the lower level attacks, the Self-Protection Service squads on the average handled 59 percent of the fires and the Fire Department squads handled 38 percent of the fires (3 percent left to other forces or were not accounted for). By July of 1943, the Fire Department units were capable of handling a maximum of about 6 fire sites/squad per attack under conflagration conditions while under similar conditions, the Self-Protection forces were capable of handling no more than 2 fire sites/squad per attack. Under fire storm conditions, the Fire Department units were capable of handling no more than about 4 fire sites/squad per attack.

While the above information may be used to develop fire fighting force requirements or to make analyses of likely fire fighting performance for nuclear attack situations in modern cities, other additional information would perhaps provide more reliable estimates. For example, the

dependence of the fire fighting effort (to a stated endpoint result) on building type and size and on time after the start of the fire when the fire fighting begins would improve such investigations; analyses of various structures in urban areas with such inputs would provide guidance to fire fighting departments in developing operational plans for nuclear attack conditions. Results from all such analyses, however, may require modification by constraints on operations such as those which hampered the Hamburg Fire Department Units in World War II situations. These are summarized in the following section.

Fire Chief Brunswig[8] gives the special tactics of fire fighting after an air attack, as issued by the Hamburg Police Department in September 1943 as follows (for war-time conditions):

1. Fundamentally, where the preservation of living space and valuable materials is at stake, water hoses may be deployed. However, burning buildings are to be saved only when the lives of human beings are endangered or when a danger to neighboring buildings exists.

2. In order to shorten the period of deployment at individual fires, civil defense forces are to be used to the greatest extent possible to aid in fire fighting.

3. Whenever it is possible to assign the continued task of fire extinction to available civil defense services with small equipment, the overall attack on the fire is to be discontinued.

4. When at all possible, the fires should be fought from the inside because this method will usually bring the greatest degree of success with the least amount of water.

5. Fire fighting from the outside is recommended for situations involving industrial fires, lumberyard fires, and other such fires or where the main objective is only to confine the fires and prevent their spreading to neighboring buildings or facilities. Attack on the fire from the outside may also be used where danger of collapse exists.

6. Even when industrial buildings are fully aflame, the use of large amounts of water to preserve valuable machinery or to help such machinery from thermal deformation may be justified.

He (Brunswig) goes on to say that these guidelines were often ignored in actual practice because of lack of training of unit leaders and because of external pressures on them to do something. The main concept for the fire fighting forces is to avoid deployments to sites where the fire has developed to a stage that precludes its rapid extinction by the deployed forces at hand; rather, time and purposeful efforts should be mounted to confine those fires that appear to be in the process of proliferation(spreading).

OPERATIONAL CONSTRAINTS EXPERIENCED BY THE FIRE FIGHTING FORCES IN HAMBURG DURING WORLD WAR II

The constraints that the fire fighting units were subjected to during and after the air attacks on Hamburg are found in all narrative reports from the Fire and Emergency Service Squad and brigade leaders following the various raids and are especially well-summarized in the Hamburg Police President's reports on the large scale attacks of July and August 1943.

Constraints and difficulties arose at every organizational level and ranged over all operational sequences from finding out where the fires were to finding a place for the squads to rest after the last fire was out. The one constraint that is most persistent in the reports and the one that Fire Chief Brunswig of Hamburg pursued at great length in communications with Horatio Bond[9] during the 1950's is the lack of mobility of the squads and their equipment through the streets due to the accumulation of debris and the existence of bomb craters. Reconnaissance and communications problems received much attention on an organizational level even though later agreement appeared to be prevalent that the self-assignment of brigades and squads in the early stages worked very well, operationally. The control difficulties without reliable and complete information on the situation are brought out extremely well in Appendix 1 where, after the first attack on July 25, 1943, all available forces were assigned to the area of Group East while the major fires were developing in the area of Group West. Major support and service-group problems are described in Appendix 2. Other constraints and problems are included in the translated Hamburg Fire Department and other documents included as Appendices 3, 4, and 5.* A few of the major constraints are listed below as a general summary of the subject under discussion as well as a convenient reference outline for future consideration:

I. Constraints on control and assignment of forces

- observation tower views obscured by dust and smoke
- telephone lines cut
- teletype to headquarters often out-of-service
- radio station out-of-service
- failure of unit leaders to report to headquarters
- reassignment of forces at sites without permission
- reconnaissance missions delayed by debris in streets
- lack of sufficient bicycle and motorcycle messengers

II. Constraints on deployment of forces

- rubble and debris in the streets

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* These appendices are to be published separately.

- bomb craters
- debris-blockage of canals and rivers
- tire punctures in passable streets
- heat and flames plus fire storm winds
- decreased vision of drivers due to smoke, dust, and sparks

III. Constraints on fire fighting

- destruction of city water distribution system
- lack of sufficient hose to reach available water sources
- insufficient static water supplies
- locked gates and doors
- rain of firebrands, heat and flames
- coal and lumber storage in attics
- lack of provisions (drinking water and food)
- destruction of or damage to equipment by blast or fire effects
- damage to hoses by collapsing buildings
- damage to hoses by vehicles through inadequate hose brigades
- damage to hoses due to poorly-made hose connector fittings
- hoses too small to carry sufficient water
- lack of reserves to relieve tired crews
- manual laying of hose lines and carrying of pumps over debris and rubble
- pump failure due to improper break-in or other engine troubles
- non-standard equipment of volunteer fire fighting units

IV. Training and performance constraints

- regular professional units were well trained and usually performed well
- fatigue after long hours of duty
- age of many Fire and Emergency Service personnel
- industrial civil defense squads were well trained but many were evacuated or could not report for duty without public transportation; some did not report or left duty stations
- expanded self-protection service units did not perform up to professional standards according to views of the fire department unit leaders
- self-protection service groups generally performed well until overwhelmed and disorganized through forced and voluntary evacuation after the heavy attack on 7/25/43
- voluntary fire fighting units were poorly trained, poorly equipped, and poorly led
- rapid response units were well-trained, well-led, and performed very well but had too light equipment and were relatively few in number

V. Rescue operation constraints

- many fire unit leaders insisted fire fighting was the prime mission of the fire department
- only until 6 hours after the start of the attack on July 27/28 was notice given by headquarters that units in local areas would be used only for rescue operations
- water sources were not always near shelters
- false impression of outside conditions by shelter commanders
- shelterees often refused to leave shelter and had to be forced to leave
- many shelterees became apathetic and wasted precious time
- debris covered many shelter exits

Brunswig[8], critical of the World War II Hamburg air defense organization and its political leadership, suggests three major organization constraints on efficient fire fighting operations: (1) the duplicate command situation (Leader of the SS vs the Police Chief); (2) the lack of coordination among the Fire and Emergency Service units, largely as a result of (1), and (3) the lack of professional knowledge of the techniques and tactics of fire fighting and fire confinement by those in authority (who, nevertheless, meddled in these essential matters of fire protection). The problem of "debris-in-the-street" apparently did not become serious until the large scale attacks in 1943.[8] After that, the dropping of heavier high explosive bombs, along with the systematic bombing of access roads and highways and the occasional collapse of entire rows of buildings, often created debris situations in which the available vehicles could not move. In the large scale attacks, literally hundreds of vehicles of all kinds were in Hamburg near the area fire regions but none of them could enter the area because of the debris. Others, even if operable, could not get out. One entire Fire and Emergency Service brigade was trapped on Steindamm (7/28/43) which was only in the border region of the main fire area; the brigade was caught by debris from the sudden collapse of buildings that took place within two hours after the attack. Their equipment was burned and the crews barely escaped alive.

After the attack, traffic in Hamburg did not begin to move even slowly on the streets until several thousand troops were moved in and cleared the streets with shovels and other earth-moving equipment. Entire areas, such as the Hammerbrook district, remained blocked off to traffic for a long time. All attempts to drive over the loose rubble and debris with half-track, full-track, and light armored reconnaissance vehicles failed. With respect to the rescue of persons buried under collapsed buildings, Brunswig[8] further states "The amount of debris after an air attack (on Hamburg) was inconceivable. One could see pieces of lumber of different sizes, furniture, appliances, steel girders, and pieces of mortar, brick

and plaster on top of the shelters. One could hear muffled calls for help coming from those buried beneath the debris in the shelters. Smoldering embers from toppled stoves and burning gas from broken gas lines caused the debris to ignite, sometimes at a depth of several meters below the surface." When this happened, those buried beneath the rubble usually died because the fires usually could not be extinguished without drowning the occupants and the people would die from CO, or the heat, before the burning debris could be removed.

SURVIVAL IN THE MASS FIRE AREAS

Information on survival in the mass fire areas comes mainly from summary reports and personal experience accounts of which several are presented in Appendix 5.* Actually no survival data as such can be found in the Hamburg Fire Department documents except for the notes regarding the rescue of a total of 18,000 persons during the 7/25/43 to 8/4/43 period.

The Fire Department, however, did show that structures near the periphery of a fire storm can be saved when it prevented the Main Fire Station from burning down through intense fire fighting efforts of a sufficiently large well-trained, well-equipped, and dedicated crew of fire fighters.

Some observers actually were surprised at the number of people that escaped alive from the fire storm area, believing that no one could or would escape. The Police President's report[7] states "Air raid wardens, who were no different than anyone else, had no idea of the degree of terror and destruction in the streets and had to rely on instinct. The obvious impossibility of leading the shelter occupants in their charge through the sea of flames made them regard the shelter as a safe place until the end. The completely altered appearance, due to the all-enveloping fire storm and the collapse of buildings all around in a neighborhood normally known to the smallest detail, made it almost impossible for anyone to find his way. Under these circumstances, considering the large number of people living in the affected area, it can only be regarded as a miracle that the number of deaths was not many times greater. That hundreds of thousands were able to escape from this fire storm area bears witness to the courage with which all people worked. In raids of this magnitude, whose prevention is not within the sphere of responsibility of civil defense, loss of life and property must be expected on a scale beyond all human experience."

In contrast, it is also frequently stated that the occupants of endangered shelters often were so demoralized by the intensity and severity of the bombardment that they were transformed to a condition of apathy and simply waited calmly for death. And that they appeared to feel most secure and safe in the shelters and cellars and often refused to come out even when rescue teams arrived to take them to a place of safety.

For people who died in the streets, the main cause of death has been given as hyperthermy[1] and it is believed[8] that many of these people were accidentally overtaken by fiery whirlwinds that were occasionally observed to race down the street at a great speed. Also, towers or virtual walls of flame were also seen going with the fire storm winds down the street heavily laden with sparks and firebrands. The diameter of the fiery

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* This appendix is to be published separately.

whirlwinds were usually small and when they overtook a person or two in the street they would be immediately transformed into burning objects. Other people, at a distance away of not more than a half-width of a street usually went on uninjured. Thus, to some degree, death in the streets occurred by chance. In most cases, however, exposure to excessive heat for too long a period was, as stated above, the major cause of death.

The personal experience reports of survivors indicate that people survived in bomb craters in the streets in the midst of the mass fire area where the craters were sufficiently deep to provide shielding from the burning buildings, especially where the water table was sufficiently high to provide water that could be used to soak clothes to keep firebrands from setting them on fire (or where broken water mains provided water for the same purpose).

Where sufficient water was available to wet down clothes and blankets and the force of the storms was not so strong as to prevent walking, people were able to leave their shelters and make their way to places of safety if the safe area could be reached within 10 minutes. Under more severe conditions such escape was possible only by crawling on the street as close to a curb as feasible. In most reported instances, strong leadership was required to bring more than one or two people out.

People survived in shelters in the midst of the fire area so long as the shelter provided shielding from the outside heat, shrapnel, and flying sparks and when the fire did not penetrate the shelter and the air did not become loaded with smoke, CO, and CO_2. Such protection was generally provided by the public bunkers and, except for direct hits on the bunkers by high explosive bombs, no deaths or injuries were reported for persons sheltered in the bunkers. The combined heat of the outside fires and from the people inside in several instances was indicated as being almost beyond the point of human endurance. In one case this condition was relieved when the fire fighting crews were able to cool the shelter down by spraying the outside surface with water.

For out-of-shelter survival, the reports suggest that survival over an extended period was possible without water for wetting down clothes at the center of an open area only when the radius of the area was more than 75 meters (150 feet). When such an area was wooded or covered with shrubs, survival was more assured. Escape by walking upright through the streets, even with wetted blankets, apparently was not possible when the flames from buildings on opposite sides of the street joined. Escape by crawling along the street with wetted clothes and blankets generally was possible when the time required to reach safety was less than about 15 minutes and when the street was at least 8 meters (24 feet) wide from curb-to-curb. These conditions are approximate since they are deduced indirectly from

a variety of personal experience reports included in the Hamburg Fire Department documents and Police President's reports. Also, in view of the occasional apparent rapid and sporadic changes in thermal conditions in the streets (e.g., the whirlwinds mentioned above), the conditions mentioned for escape cannot be stated to be threshold conditions of assured survival while moving about in a fire storm. And no information was found in the documents from which a frequency distribution for survival rates could be deduced for the described situation.

IMPLICATIONS OF THE HAMBURG WORLD WAR II DATA ON CURRENT CIVIL DEFENSE PLANNING

Most major implications of the Hamburg World War II experience on current civil defense planning with regard to techniques and tactics of fighting large area fires or other smaller fires in modern cities have been brought out by experts in the field such as Horatio Bond, [9] Hans Brunswig, [8] and others. Therefore techniques and tactics implications are not discussed here in any detail. The one main difficulty in the transfer of the German World War II experience to the nuclear attack case is that of the difference in size of the weapons with respect to the blast effects as well as the possibility of the radiation hazard being added for the nuclear weapon attack situation on account of the fallout that may be produced.

A second class of difficulties involves differences in the density, type, and geometric arrangement of fuel and other materials in the urban target area. Very few modern cities, if any, for example, have a surface density of wood in structures that would be anywhere near being equal to that of the preattack Hammerbrook district in Hamburg. Many modern American cities in which the fire fighting forces depend exclusively on the municipal water distribution system for a water supply would have no professional fire fighting capability following a nuclear attack in which one of its residential areas received blast effects amounting to no more than 2 psi.

As soon as MIRV capabilities become operational realities, [10] the greater possibility of the use of relatively low nuclear yield weapons in nuclear arsenals would make the experiences of Hamburg and of Hiroshima and Nagaski more applicable to direct interpretation for civil defense purposes. For these situations and perhaps even for the situation where larger nuclear detonations are involved, some of the basic concepts of fire fighting when area fires develop would be theoretically applicable to the current situation (providing the water problem described above would not be a controlling factor--i.e., water is provided through other means).

A Hamburg Fire Department group leader reported after the third large attack on July 30, 1943, that: "The experiences from this air attack proved once again that assignment of fire fighting forces within the confines of the fire area is useless and, further, such assignments are impossible because of the inability to move on surface streets" (because of the debris and bomb craters). "One exception, of course, is the deployment for rescue to save human lives."

"It is a basic principle that fire fighting must take place only at those fire sites where there is promise of success. The locations for greatest likelihood of successful fire fighting are usually confined to the sites on the periphery of an area fire; an attack on the area fire itself usually means nothing other than the extinguishing of fires in the debris."

The peripheral zones about the three major area fire regions in which many bombs fell and in which it is estimated that as many as 22,500 individual or row-house fires occurred[8] were up to 0.5 miles in width. A somewhat analogous situation has been deduced on an analytical basis for the nuclear attack case[11] in which 3 basic hazard conditions (relative to civil defense operations) are described in terms of the amount of debris produced by the blast effects of one or more nuclear detonations in a urban area. The relative amount of debris is considered as being the major constraint on movement of civil defense units in the damaged area. Major fire areas, area fires, or even group fires approaching the intensity of a fire storm are generally considered possible only for fire-susceptible areas where the blast damage to the buildings is relatively light. These would be peripheral areas, as described for Hamburg, in which the debris would be minimal on the side furthest from the point(s) of detonation. Thus the outside boundaries of these regions would offer opportunities for fighting fires when they are not denied by the arrival of fallout in the meantime. Without the latter, the controlling constraint on the fire fighting operations in both the Hamburg case and the case derived for the nuclear attack is the amount of debris in the streets.

In the large scale air attacks on Hamburg, the professional fire fighting forces, perhaps larger on a per-capita or per-structure basis than for a modern city, was able to fight only at about 5 to 10 percent of the fire sites even after three years of responding to air-raid-caused fires. Without extrapolating to worse conditions for the nuclear attack case, it doesn't appear that the professional fire fighting units could, with highest possible effort, change the fire damage statistics very much for a nuclear attack on a city. However, the rather surprising high relative performance of the Self-Protection Service units of Hamburg even through the heavy attack and large area fires on 7/25/43 indicates the possibility for a fire fighting force whose efforts could influence the fire damage statistics in a nuclear attack on cities.

While the purpose of a self-help fire fighting service for the nuclear situation might be almost identical to that laid down for the Self-Protection Serivce organization of Hamburg--the suppression or extinguishment of small fires as rapidly as possible and before they become too large to be extinguished by any group--the nuclear attack case would involve putting out fires already ignited in exposed fuels whereas the World War II case

started out with extinguishing burning fire bombs and parts of bombs (later on in the attack, more thermal-ignited fires were involved). The later-extinguishing of firebrands and falling sparks, of course, was encouraged in the Hamburg case and, at many fire sites, the Fire Department units made issue over the assignment of afterhosing and fire-watch duties to the Self-Protection forces. Where only light equipment were available, the afterhosing function was clearly not feasible for the non-professionals.

In cases where water supplies could not be assured and alternate methods (e.g., chemicals) with very light equipment would be selected for use by rapid response squads, the German experience might suggest teams of about 3 instead of 7 persons and a designed performance rate of no more than 2 fire sites/team (per attack). The detailed design of such groups is a problem for the professionals and therefore is not discussed further here. The official German documents indicate that a large amount of urging and even coercion was, or had to be, used even during the course of the war to get the Self-Protection Service organized, equipped, and to an operational state of readiness. Yet the record of attendance of these units at fire sites was shown to be about the same from the first air attack in May 1940 until they were overwhelmed and effectively disbanded after the first large scale air raid in July 1943. Thus it is clear that these units "worked" and, if they had been given more willing assistance from the professionals and less by the SS politicians, they might have worked even better. The analyses of Reference 11 show that many situations would arise in the early stages of a nuclear attack where teams could operate out of shelters to extinguish fires. Additional analyses of the kind described would undoubtedly reveal many more deployment opportunities for such teams.

The operational model that was derived and the parameters that were evaluated for the Hamburg Fire Department units probably are not applicable to any fire department in the United States. However, the models and the analyses do suggest the types of information that are needed and which can be used to evaluate current capabilities or, conversely, used to derive needed capabilities for a desired performance level. Any such analyses should consider that, whereas the debris problems severely constrained the deployment of the Hamburg Fire Department units, the problems of debris-in-streets would be an even more severe problem for the case of nuclear detonations over modern cities. The large-yield nuclear detonations can generate and move more debris than has been previously observed for any conventional attack and the modern cities generally contain a much higher fraction of non-burnable building materials than the pre-World War II cities of Germany (and Japan).

In summary, the Hamburg information substantiates previously-derived

concepts regarding the importance of debris in the streets as a constraint on fire fighting operations.[11] This constraint finally enforced the peripheral-area concept of containing the area fires by fire fighting forces. Second, the relatively high performance rate of the Self-Protection Service groups suggests that the non-professional citizen, with a small amount of training, guidance, equipment, leadership, and perhaps coercion, could contribute statistically to the reduction of fire damage in a nuclear war. The debris, the likely lack of water, and the apparent lack of a sufficient number of personnel would deny the professional fire fighting units, by themselves, the opportunity of making any statistically-countable contributions to the reduction of fire damage in a nuclear attack on American cities.

On the basis of information given in the Hamburg Fire Department Documents and by Schubert,[6] the relative strength of the Hamburg professional fire fighting forces in July of 1943 was 2.34×10^{-3} firemen per capita. Census information indicates that the relative strength of the professional fire fighting forces in the United States was as follows:

Average for Entire U.S. (1960):	0.77×10^{-3} firemen/capita
Average for Entire U.S. (1966):	0.88×10^{-3} firemen/capita
Average for All U.S. Cities (1966):	1.33×10^{-3} firemen/capita
Average for U.S. Cities with more than 50,000 people (1966):	1.71×10^{-3} firemen/capita

These relative strengths, of course, are only very qualitative indicators of the relative capabilities of the fire fighting forces of U.S. cities to cope with mass fires as was done in 1943 by the Hamburg Fire Department. The size of the urban area per fire fighting unit, the number and type of structures in that area, and the availability of modern equipment and methods would be additional factors that must be considered. The qualitative indicators, together with the likely additional constraints on fire fighting operations that could arise in the nuclear attack case, however, suggest that the relative strength of professional fire fighting forces of the U.S. cities would be less sufficient for that case than were the forces of the Hamburg Fire Department in fighting the fires in Hamburg in July and August of 1943.

SUMMARY AND CONCLUSIONS

Information recorded by the Hamburg Fire Department during World War II has been summarized and analyzed to evaluate several operational parameters relating to the performance of the various fire fighting organizations under conditions of stress from air attacks on the city. Prior to the large scale attacks, the professional fire fighting units fought at about 38 percent of the fire sites while the Self-Protection Service squads fought at about 59 percent of the fire sites.

Finally, in the major air attacks during the period 7/25/43 to 8/4/43, when the capabilities of both the professional and Self-Protection units were exceeded, a maximum performance or effort level was reached for the Self-Protection Services at about 2 fire sites/squad per attack and, for the Fire Department units at about 6 fire sites/squad per attack. Because of the failure of the municipal water system and the evacuation (forced and voluntary) of large numbers of people, the Self-Protection Service did not function to any great extent after the first of these large scale attacks on 7/25/43. However, at the above-indicated rate, the Self-Protection Service was credited with extinguishing fires in about 20,000 residential buildings over the 11-day period. The Hamburg Fire Department units, on the other hand, performed more or less continuously over the 11-day period with a continuously decreasing efficiency; its units either extinguished fires or prevented the spread of fires at about 4,300 fire sites. Water volume use rates by the Fire Department units was found to increase with fire fighting effort (i.e., in man-hours) to the 3/2 power.

The Hamburg Police President makes 6 major comments on the performance of non-professional civil defense services (Self-Protection, Expanded Self-Protection, Industrial Civil Defense, and Special Services) during and after the major attacks in July and August 1943:[7]

1. These units are reconfirmed as the backbone of the whole Air (Civil) Defense Service and their successful use is a prerequisite for having a capability to deal with air raid damages in the future.

2. In the major fires areas, the Self-Protection Service had no objective that it could hope to achieve with success.* (Many who did attempt to carry out tasks were killed by fire or by high explosive detonations.)

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* The same situation proved to be true for the professional units.

3. The limit of achievements of the professionals depends on those of the Self-Protection Service and the limit of achievements of the latter depend on the severity of the attack; these limitations are generally admitted and accepted.

4. Outside the area fire and fire storm regions, the non-professional units were employed with success as in earlier raids. (Occasional misbehavior of groups is also admitted and understood.)

5. The morale of the non-professional units did not suffer a breakdown. Even in the fire storm, many willingly performed their duty, often to the end.

6. The service must be reconstituted. (The appeal for this is given in Appendix 12[4] along with many comments on techniques and procedures.)

The major constraint in deploying the fire fighting units to fire sites, according to the reports, was debris in the streets. Once at a fire site, the most-often mentioned difficulties were those of supplying water, the heat and spark showers and smoke, and of maintaining the hose lines. The main difficulties faced by the district headquarters were in locating the major fire areas as rapidly as possible and in finding out the whereabouts of the fire fighting squads who, without communications, assigned themselves to fire sites (as per directive).

The reports indicate that no person in the bunkers died from fire effects, as has been reported previously.[7, 8] No specific survival rate data for either shelter or fire conditions are given in the Hamburg Fire Department documents. Outside survival within the fire areas appeared to be possible for an extended period only when the radius of the open area was 75 meters or more. In the extreme case, escape from the fire storm area by crawling on the street near the curb appeared to be feasible when the streets were at least 8 meters wide (curb-to-curb) and when safety could be reached in about 15 minutes. The case of survival in one of many small bomb craters would not generally be applicable in a nuclear attack situation.

The translated documents included in Appendices 1 through 5* are included both as reference material for the report as well as background information that provides viewpoints of involved persons together with detailed descriptions of events that took place in the streets and buildings along with the howling noise of the fire storms.

The major implications of the experiences in Hamburg during the World War II air attacks on present day civil defense planning are: (1) the

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* Appendices 3, 4, and 5 are to be published separately.

restriction on movement of vehicles and people through the streets in the major damaged areas because of debris and (2) the rather high relative performance of the self-protection service units in extinguishing fires. The analytical results leading to these statements involved the use of parameters that could also be utilized to evaluate overall capabilities and to develop performance requirements of modern fire department units for duty under disasterous fire conditions. Further analyses of the debris problem may be required to establish local options on both concepts and tactics for the best use of the urban fire fighting forces in the conduct of civil defense operations for the nuclear attack case.

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Appendix 1

Short Version

of

REPORT ON EXPERIENCES OF THE HAMBURG FIRE DEPARTMENT DURING THE AIR ATTACKS FROM JULY 24 TO AUGUST 3, 1943

by the

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REPORT COVERING THE EXPERIENCES OF THE FIRE AND EMERGENCY SERVICES DURING THE AIR ATTACK ON HAMBURG DURING THE PERIOD JULY 24 TO AUGUST 3, 1943.

The air attacks in the period from July 24 to August 3 produced great devastation--principally due to the fire damage that followed. During all the preceding air attacks (except one) the forces of the Fire and Emergency Services were sufficient to control the damage; the first time that the number of large fires (508) was so great that 87 burning buildings had to be ignored and were left to burn down took place during the attack of July 26/27, 1942. In comparison, the extent of the fire areas and the number of burning buildings during the four large air attacks in July and August of 1943 were so enormously large that effective fire fighting measures could be carried out on only a small fraction of the damaged buildings. A report on the course of the attacks and the experiences gained from them follows.

A. PRELIMINARY MEASURES

Expansion of the Fire Forces and Fire Fighting Equipment

Based upon the experiences during the air attack of July 26/27, 1942, on Hamburg as well as the experience reports from other Air Defense Districts, efforts were made to increase the strength of the fire service to its greatest possible level. To accomplish this purpose, the filling of rosters was vigorously undertaken and the condition of the fire engines and other equipment was improved as much as was possible. Following the air attack of July 26/27, 1942, 35 additional motor pumpers of type LF 15 and 16 additional motor pumpers of type LF 25 were procured. The 48 decontamination squads were equipped for the most part with LF equipment and, where possible, with TS type equipment.

From the volunteer fire service in the area of the Air Defense District of Hamburg, the members of the Rapid Response Units and the members of the Hitler Youth fire services, 65 fire fighting groups of the Reinforced Fire Service (VFD) were formed under the leadership of members of the Fire and Emergency Service. The Self-Protection, the Expanded Self-Protection, and the Industrial Air Defense Units were equipped with 370 motor pumpers of type TS-8. The local groups of the Nazi Party had 200 motor pumpers type TS-8. In addition, 30 motor pumpers type TS-8 were procured and stored in the Harbor area in Sonnenblumenkerne to be distributed to the Industrial Air Defense and the decontamination units. Furthermore, 120 additional motor pumpers of type TS-8 were requested for the Industrial Air Defense

units, for the decontamination units, and for the Nazi Party units; for that purpose 1140 units of suction hose, 120,000 meters of German pressure hose and 40,000 meters of Dutch pressure hose were prepared. It was planned that each of the 150 Rapid Response Units would be equipped with a motor pumper of type TS-4.

About 36 of these units already had a motor pumper type TS and the remainder were equipped only to use water directly from the city hydrants. To reduce difficulties encountered in the repair and maintenance of vehicles of the Fire and Emergency Service and the motor pumpers of the Industrial Air Defense, the Decontamination Groups, the Special Services, the Nazi Party, and the Rapid Response Units, a special maintenance service was established. The head machinist had already produced 23 small usable motorcycles and additional motorcycles were procured for scouting purposes. The total useful pumping equipment that existed at the beginning of the air attack on the Air Defense District, Hamburg, on July 25, 1943, consisted of: 305 fire engines, 935 trailer pumps and 49 fire boats. For the information of external fire fighting forces, an "informational plan" had been prepared by the Fire and Emergency division staff, in which the positions of independent water supplies and command stations were given. Information concerning preliminary measures in the areas of the Technical Service, the Intelligence Service and the water supply has been reported separately.

Preparation of Services

The preparation of all fire and emergency service forces was energetically undertaken. The non-commissioned officers were given regular weekly training. This training had a special purpose in producing non-coms who could undertake assignments on their own initiative. This training was later to prove of special value in the rapid reporting of a clear picture of situations by the non-coms. In the work of the fire and emergency division staffs and the section command posts, fire fighting methods and procedures were worked out and always reinforced by training.

In all the decontamination units that were provided with trailer motor pumpers the personnel were instructed in their area and were made acquainted with the local position of the Industrial Air Defense units.

The state of preparedness was rapidly improved through training exercises under observation of appropriate officials. Necessary continued development of the personnel as machinists and other skills was provided.

The membership of the Special Forces was acquainted with their work at their places of employment but was, nevertheless, given instruction. Within the German railroad service alone 1071 members and 387 machinists were given a basic training in air defense. The political leaders of the Nazi Party provided their 200 motor pumper troops with the same training. A slightly

different training course was provided to the machinists. A liaison officer of the Fire Defense Police provided for the smooth cooperation with the Nazi Party groups.

All officers and members of the Rapid Response Units (i.e., the Schnell Kommandos) who had taken the required training were given instructions for deployment in the Reinforced Fire Fighting Services. The training had to be maintained for the Rapid Response Units very often were ordered to exchange duty with the Fire Service.

B. THE COURSE OF THE ATTACKS

Air Attack of July 24/25, 1943

The first message that the tower observer was able to send in to headquarters stated that a concentrated attack on Hamburg was taking place and that the inner city was being heavily hit. Fifteen minutes after the first bomb landed and detonated, the telephone connection to Group West was cut off. Because of this, a totally false picture of the damage situation developed at the local headquarters, especially with the continual receipt of messages and requests from Group East for additional fire fighting forces. As a result, within only 45 minutes after the attack started, eleven divisional units had been ordered to go to Sectors VI and X in the area of Group East. Shortly thereafter two divisional units were sent to report to Group Harbor. The fact that the major damage area with many uncontrolled fires was in Group West's sectors was first made known somewhat (almost 2 hours) later, approximately when the all clear sounded. The true extent of the catastrophe was first brought to our own attention by means of a motorcycle message.

The fire fighting forces that were in the bombed areas actually deployed themselves on their own authority since after the communication lines were severed, deployment orders could not be transmitted. The transmission of deployment commands by means of motorcycle messengers at that time was, to a large extent, purposeless since all the fire fighting forces had already taken positions at fire sites. Those that had not done so were deployed by the fire and emergency divisions in a short time after the attack began. A planned control and distribution of fire and emergency forces of the Air Defense by District Hamburg from the district headquarters could not be carried out since all groups were heavily engaged and no forces were held in reserve to be provided to assist other groups. The few forces remaining consisted mainly of the Expanded Fire Service and the Volunteer Fire Service which were then distributed among the Air Defense Fire and Emergency Service groups already in action. The principal means by which the district headquarters knew of the locations of the units was through motorcycle messages and meeting with fire service units in the fire area.

In failing to understand the real damage position, headquarters assigned strong forces to the area of Group East while other units were deployed there on their own authority. To re-deploy many of these fire fighting units in the inner city, a command post was prepared at Adolf Hitler Place near fire station 3. The command post of Division III had to be abandoned. In the meantime the deployed units were commanded from the various division command posts or from advantageously positioned Air Defense Precinct Police stations. The district headquarters was located in the middle of a fire area. The city hall itself was on fire. But, because of the many fires and the blocking off of the streets by debris, it proved to be impossible to obtain sufficient fire fighting forces to put out the fire in city hall, even though an officer had been dispatched to the scene with that special mission to accomplish.

Although advice was transmitted not to use the communication services of the district headquarters, telephone connections of the Fire and Emergency Service remained in use from Groups East and Harbor as well as to several command stations in Group West. These connections permitted some degree of control over the distribution of the fire fighting forces that were arriving in the area from time to time. During the several hours following the change in district headquarters to the police precinct station in Feldbrunnen street, extraordinary difficulties in command and control arose since, in the already heavily manned command station, none of the telephones were in order. Because of this new loss of communications with the operating groups, the real view of the widening development of the fires was very quickly lost. But through individual personal reports of the Fire and Emergency Service group leaders, the Air Defense Command group gradually became aware that huge fire areas existed in the sectors of Group West in which no fire fighting forces were positioned. It was also known that these fires could only be fought by fire fighting units that could be released from duty at other fire sites. Afterwards, all such available units were sent to the area of Group West. About 11 o'clock in the morning, the described situation was reported to the state governor through the commander of the Fire and Emergency Service. This report was followed by a talk that took place between higher SS and the police president. Following these meetings, orders were given out that isolated fires should be left alone and that units fighting isolated fires should be removed from such sites and sent to the fire areas in the sectors under Group West. The units from external Air Defense districts were to be withdrawn and returned to home station at 4 p.m. During the night the clean-up or afterhosing work was to be taken over by external fire fighting units. The forces of the Hamburg Air Defense district were to be pulled out of action and were to prepare themselves for a new attack on the fires. The Air Defense motorized divisions were also to be removed and were to stay in readiness for action in the immediate vicinity of the city limits.

These plans and preparations were nullified by the day-time attack in the afternoon of July 25, 1943. This attack produced damage principally in the

harbor area and new fire damage sites in the city section of Harvestehude. The urgent requests from Group Harbor for the assignment of additional fire fighting forces could not be met for some time.

During the night, all the fire fighting units in action remained deployed since large fires were still burning everywhere. These numerous bright fires caused the higher SS and police authorities to insist with great vigor that all the fire forces should remain on duty at their positions. They ordered that all fire sites must be made dark by 12:00 midnight. These orders could not be carried out. They were issued to the district headquarters apparently because the authorities had an incomplete view of the actual situation and the actual capabilities of the external units and volunteer fire fighting units available. These units were not under control. They either left their positions without notifying the district headquarters or went to alternate fire sites without orders and without notifying the district headquarters.

Later determinations showed that through the two air attacks on July 25, 1943, the total burned area, principally in Group West, covered about 4 square kilometers in area. The area over which fires occurred had a maximum distance, or spread, of 25.7 kilometers. The building frontage that had burned out totaled 87 kilometers in length. In addition to the totally burned-out area, a very large number of isolated fire sites were produced. A total of 609 fire fighting squads were in action in fighting these fires (including the forces of non-department units, the out-of-town forces, and others).

The above estimates of the fire-damaged area clearly show that the fire forces attacking the gigantic fires were not nearly sufficient. It was evident that the streets within the fire areas could not be traveled due to the presence of all types of debris. The fire fighting units could therefore only break through the periphery of the fire area here and there. More success accompanied the fire fighting operations upon the isolated fires outside the main burning area since here the isolated fire could be put out or the adjoining houses could be kept from burning. The operational difficulties, even for the isolated fire sites, were also very great since the water mains in the struck areas for the most part were damaged and water had to be obtained from static water sources. This often required the laying out of long hose lines. It also required that a part of the deployed forces had to be used to provide water supplies and could not therefore be used to fight fires.

In regard to the success of the fire fighting work, it was established that with 342 serviceable fire fighting squads of the Fire and Emergency Service of Hamburg, 2404 assignments were carried out and these were:

in 1028 cases fires in burning houses were extinguished;

in 255 cases fire attacks were carried out from neighboring buildings and prevented a spread of the fire;
in 519 cases fires were fought and the force of the fires was diminished;
in 445 cases units were assigned to afterhosing clean-up operations;
in 42 cases human rescues were conducted or made possible;
in 57 cases valuable equipment was saved or salvaged;
and in 58 cases long hose lines were laid out and water supplied.

The above information gives an average of 7 assignments or deployments per squad.

Clean-up Work of July 26/27, 1943

The afterhosing and clean-up work had to be carried out with an all-out effort by the crews on both days. Practically all the Air Defense District forces of Hamburg remained continuously on duty and were moved from one fire site or area to another. The communications between the command stations and the brigades and squads at the fire sites was so poor and the view of the situation at the command stations so bad that, for example, a message to be sent out at 8 a.m. on July 26 concerning the number of fires remaining to fight could not be prepared for delivery until 1 p.m. The message then stated that 211 mass fires existed in the area of Group West and that 17 more fire fighting units were required to put them out. Yet, at 6 p.m. on July 27, the number of fire sites in the area of Group West was determined to be 1120 and, of these, 50 were large, or mass, fires. As a result of this situation, the external fire fighting units and the volunteer fire fighting forces had to remain in Hamburg for the greatest part of these two days or were always to be available for action on call.

Another daylight attack on July 27 caused only a relatively few new fire damage sites in the harbor area and in Hamburg which the available fire fighting forces extinguished with no difficulty.

During the night of July 26/27, numerous remaining fire sites appeared to be vigorously burning in the darkness, especially the glowing coke bunkers that by day were scarcely noticeable. Continuous new requests for fire fighting forces came in. The brightly-lighted coal fires caused the governor to insist that all available forces be deployed in the damaged Group West area. Up to July 27 and during that night, all available forces were sent to the area of Group West. The damaged region was divided into small fire areas with one officer stationed in each area and with continuous supervision maintained by communications using an organized motorcycle corps. In this manner all fire flare-ups could be rapidly detected and extinguished. In addition, the water basins were refilled. During the night of July 27/28, 106 power-hose units of the Nazi Party were ordered to the scene. The on-duty Fire and Emergency Service groups and units were becoming

stripped of both personnel and leaders due to fatigue and other causes. The personnel of the fire services were very tired, in the meantime, from the day long fire work and they had had, for the most part, no rest breaks. During the first day after the attack virtually no water and food were provided and during the ensuing days only a very limited supply of food could be provided. In the event of an air alarm the on-duty forces were under orders to leave fire sites and go to shelter.

The casualties suffered by the Fire and Emergency Service Units in Air Defense District-Hamburg from 7/25/43 through 7/27/43 consisted of: 8 dead, 11 missing, 21 severely injured and 61 slightly injured.

Equipment suffered the following damages: 8 fire engines destroyed, 27 fire engines damaged, and, in addition, 3 power ladders, 4 hose carriers, 1 automobile and 20 motorcycles were destroyed or damaged. A number of the damaged vehicles could be made up by obtaining vehicles from the Reinforced Fire Service (VHD) so that on the evening of July 27 of the 30 Fire and Emergency Service units existing, 25 were in condition to go into action.

Air Attack on July 27/28, 1943

The new air attack created a carpet of bombs of greatest intensity in the Viddel, Rothenburgsort, Hammerberok, Borgfelde, Eilbeck, Hamm and Horn sections of the area of Group East which, at the time, was only weakly manned with fire fighting forces. The development of the fire area and the growth of the fire storm were extraordinarily rapid. Within 20 minutes after the first bomb detonation, the Berlinertor and Rothenburgsort vicinities reported rapidly growing fires. The water distribution system was completely disrupted in a short time after the attack started. The command post of Division IV and the nearby Fire Station 6 had to be evacuated within 30 minutes after beginning of the attack. At that time such a heavy rain of firebrands was taking place that not everyone could find their way to the Elbe. An attempt was made to fight the fires in the buildings in the vicinity of Beilhafen. However, the hoses were not used to fight the fires but instead were used to rescue numerous persons from the air raid shelters of the burning buildings by spraying water over them. By that time both the heat in the streets and the firebrand storm were so intense that the people could not come out of the houses by themselves. Other fire fighting units disposed themselves in similar ways in the target area and assisted in the rescue of people. In rescuing the people from the shelters and leading them to safety, the spraying of water on the streets was important in protecting the people from the heat and the flames. Approximately 15,000 people were rescued from the fire storm and brought to safety by the Fire and Emergency Service units by these means.

The total targeted region of about 13 square kilometers of the city became a single gigantic fire area burning out of control. The fire storm rose in

intensity over a period of 2 hours time to a typhoon of such force that many trees with trunks up to 1 meter in diameter were broken off or blown down and pieces of burning wood from walls and roofs whirled through the air. The typhoon blew masses of hot air and vortices of sparks into broken windows which set buildings afire at all stories. Under such conditions, an attack on the fires by available means was purposeless. Also, any planned deployment of fire fighting forces from the command stations was impossible since the telephone connections had been severed and the motorcycle messengers could no longer move on the streets because of the large quantities of debris. The air attack caused a great deal of fire damage besides that in the mass fire area, including other sections of the area of Group East, in many sectors of Group West, and in the harbor area. At the district headquarters, the view that the situation was extremely dangerous was obtained very rapidly because the telephone communcation connections of the Fire and Emergency Services were not destroyed. Group West was given orders at 1:30 a.m. to send 12 fire fighting squads to Group East and 6 to the harbor. This order could not be completely complied with because the units on duty in many sectors of Group West itself were still urgently needed and those fire fighting units that were actually ordered to report to Group East did not all reach their destinations. Many had to make long detours because of street blockades caused by bomb craters and debris and most were forced to remain on the perimeter of the fire area where they deployed themselves on their own authority. One fire unit was ordered to go to Steindamm and when it found that it could not proceed further nor turn around, the personnel had to flee from their vehicles. All the vehicles were completely destroyed.

Very soon after the fire storm began developing, it became clear to the district headquarters that the effects of this air attack were considerably greater than those of the previous attack. All the power hose truck units of the Air Defense District Hamburg were ordered to report for duty as were all the volunteer fire fighting units from the furthest surrounding communities. Finally, the strongest forces available were requested through the Commander of the Police. Some of these were from long distances, for example, Magdeburg and Dresden and they arrived many hours later.

From the messages of officer patrols and through personal knowledge, the Police President and the Commander of the Fire and Emergency Service gave a presentation at about 4 a.m. in the morning concerning the tremendous scale of the fire-typhoon that raged in the city. It was decided that a fire fighting defense front would be constructed from Grosse Allee above Steindamm to the Alster. All fire fighting units from outside the city and all available fire forces in all the other Air Defense districts were to be sent to the command station at the corner of Alsterdamm and Lombards bridge. The preparation of the defense front was, according to plan, to use the Alster as a source of water since it was possible to lay long hose lines from it to the planned defense front. It was apparent that the construction of such a defense front would take a great deal of time. And by the time

that the hose lines were laid out and fully operable, the force of the fire storm had already abated so that the danger of a rapid spreading of the fires to other areas of the city no longer existed. In spite of this change in the fire situation, the command station remained in operation at Lombards Bridge until late on the afternoon of July 28 and it was backed up by and in communication with another more distant command post at the Krugkoppel Bridge. The fire fighting units were deployed from both command posts along the fire perimeter and at isolated fire sites according to plan and from which they continuously generated new tasks. The command station at Lombards Bridge was connected by field telephone to the district headquarters. External fire fighting units that arrived from the south and east were sent from pilot stations to the fire perimeter to carry out rescue and fire fighting operations.

The fire fighting was continued through the entire night of July 28/29 and also on the following day. Most of the outside fire fighting units remained in Hamburg with only the Fire and Emergency forces of other Air Defense Districts leaving during the afternoon of July 28. A day attack in the morning of July 29 on Kiel required all the motorized divisions of the Air Defense District to be withdrawn and sent to Kiel. The withdrawal of these forces enormously increased the difficulties of fire fighting since fires that had been partially extinguished were left and fire fighting units had to move from one fire to another of more importance. In carrying out the fire fighting, the rule was that only at such fire sites where there still remained something that could be saved would the fire be fought. All serviceable decontamination teams of Air Defense District Hamburg were required to be deployed in Group East to recover corpses.

A later evaluation revealed that as a result of this air attack the large fire, excluding isolated fires, had burned altogether an area of 13.1 square kilometers within a circumference of 17.4 kilometers. Within the burned area, a building frontage of 215 kilometers had been destroyed by fire. In the conduct of the fire fighting, including all the outside fire fighting units, 567 fire fighting units (squads) participated so that only a small fraction of the fires could be fought. In the course of the fire fighting operations it was established that 298 serviceable fire squads of the Fire and Emergency Service of Hamburg carried out 1473 assignments and they were:

in 582 cases buiding fires were extinguished;
in 113 cases fire spread was hindered;
in 286 cases fires were fought and the force of the fires was decreased;
in 325 cases units were assigned to clean-up or afterhosing operations;
in 86 cases a total of 15,000 people were rescued;
in 37 cases valuable equipment or material was salvaged; and
in 44 cases long hose lines were laid out and water was supplied.

The above information gives an average of 5 to 6 deployments or assignments per fire fighting squad.

The casualties suffered by the Fire and Emergency Service Units of the Air Defense District of Hamburg in this air attack consisted of: 5 dead, 17 missing, 17 severely injured, and 32 lightly injured.

Vehicles received the following damages: 13 fire trucks destroyed, 12 fire trucks damaged, and in addition, 1 power ladder, 2 hose carriers, 7 automobiles and 19 motorcycles destroyed or damaged.

Of the 30 fire fighting units of the Air Defense District of Hamburg, the serviceable strength was decreased to 22.

Air Attack of July 29/30, 1943

At the start of this air attack, the greater part of the fire fighting units were busy with afterhosing tasks and clean-up work. These assignments were quickly terminated and the units made themselves ready for immediate redeployment.

From the messages received at the district headquarters, it was established that the inner city, the harbor, and in parts of the areas of Group West and East were being heavily hit by high explosive and incendiary bombs. Very soon a number of important telephone connections were broken and thereafter messages could only be sent to or received from a few separated sections of the city. In a short time requests for additional fire fighting forces were received from the inner city, the Speicherstadt in the harbor, Barmbeck, Alsterdorf, Harvestehude, and Eppendorf. The requests were more than could be met and could not be answered at once orally because the priorities had to be first established by the police president. Because the telephone connections with Group East had failed, the factual picture of the situation was slow in coming and had to be gotten through messages that were sent back from previously dispatched officer patrols. The information sent back indicated that a very large area with uncontrolled fires was present in the city regions of Uhlenhorst, Barmbeck and Winterhude. At about 4 a.m. a clear picture of the situation was known. However, by this time units of the Hamburg Fire and Emergency Service could no longer be sent to the fire area. It was planned, therefore, to deploy all arriving outside fire fighting units at the fire scene in such a way that the units would take over neighboring fire sites or sectors on their own authority. Their positions were to be determined as the fire situation appeared to them. The most dangerous boundary of the fire area was to the southern and eastern sides as determined through the reports returning from the officer patrols. Part of the outside forces were to be sent to the fire perimeter in the inner city and the harbor, but mainly to Harvestehude. It was concluded that the fires in Harvestehude should be considered dangerous and relatively important because of the

continuing flow of messages and requests for aid from the area. Further reports indicated that in the center of the fire area a fire storm was observed accompanied by a heavy rain of firebrands but at that time it was not nearly as severe as the one during the preceding attack in Rathenburgsort. Along with that report a flow of messages came in stating that people were trapped in air raid shelters and were in danger of losing their lives. In most cases conditions of danger to life did not exist and the people could be allowed to remain in the shelters. They were therefore told to wait in shelter until the fires in the vicinities had been extinguished or burned out and then could leave the bunkers without danger.

Experiences during this air attack confirmed our previous experience that deployment of fire fighting forces within the mass fire area--neglecting the deployment for rescue of people--for the purposes of extinguishing fires was of no use and, for the most part, travel in the streets was impossible. Accordingly, the fire fighting forces were deployed at the perimeter of the major fire areas and in the remaining Air Defense Sectors for fighting selected isolated fires. This mode of fire fighting went on all the day. The number of burning buildings was not so numerous as in the previous two major air attacks but so numerous that all the fires could not be fought at one time. All the fire fighting units were already exhausted from the day long deployment in Hamburg so that they were not in condition to attack the new fires energetically. Because of this, the police president ordered that the fire fighting for the night should be completely discontinued and that the fire fighting units should, where possible, be allowed to go to bunkers where they could have a peaceful night of rest. It was only to be ensured that the leadership could be reached if needed. It was directed that the most important buildings should maintain fire watches to detect any dangerous fires that happen to develop. In the case of a new air alarm it was ordered that only in heavily built up sections of the city would a deployment to rescue people be carried out rapidly. In the remainder of the city areas, fire fighting was to begin only after the all clear was sounded. The outside fire fighting units, except those from Berlin, Dresden and Wurzen, were allowed to leave; the Air Defense motorized divisions were withdrawn to the city limits.

Determinations from later information revealed that, after this air attack, practically all the Air Defense Sectors had many isolated fires and that the size of the main fire area was 5.8 square kilometers with a 16.1 kilometer perimeter. Within the main fire area the burned-out building frontage along the streets amounted to a distance of 167 kilometers. Following this air attack, 537 fire fighting units were employed during the fire fighting, including all outside fire fighting forces. It was established that 264 serviceable fire fighting squads of the Hamburg Fire and Emergency Services carried out 1731 assignments which were as follows:

in 554 cases building fires were extinguished;
in 194 cases fire spread was hindered;
in 293 cases fires were fought and the fires were diminished;

in 568 cases units were employed in clean-up or afterhosing operations;
in 11 cases the rescue of people was made possible;
in 60 cases valuable equipment or material was salvaged; and
in 51 cases water supply hose lines were set up and operated.

The above information gives an average of 6 to 7 assignments per fire unit (squad).

In this air attack the Fire and Emergency Service Units of the Air Defense District of Hamburg suffered casualties of: 19 dead, 6 missing, 6 severely wounded and 2 lightly wounded.

Vehicles received the following damages: 4 fire trucks destroyed, 5 fire trucks damaged and in addition 2 power ladders, 2 hose carriers, 5 automobiles and 7 motorcycles destroyed, 2 automobiles and 5 motorcycles damaged. Of the 30 fire units of Air Defense District, Hamburg, 21 useful fire units remained ready for duty.

Clean-up Work of July 31 to August 2, 1943

During the night of July 31, a large number of still-flaming fires were reported so that the fire fighting units did not get their anticipated rest. In the course of the following days a plan for the division of the entire group of damaged areas into smaller damage sections was developed. The sections were continually watched over by scouts on motorcycles so that any new flaming fire could be quickly spotted and reported. The fire fighting situation still presented great problems since long hose lines had to be laid down for the afterhosing and clean-up operations in all sections. The notice that 6 motorized Air Defense Fire Fighting Divisions would be available for service, 3 only for the day and 3 for the deployment by day and night, was a great help for the Air Defense District Hamburg. They were given specified damage areas to work in and were allowed to work in these areas on their own authority. We especially noted the valuable water tank trucks of the motorized Air Defense Divisions. Subsequently, an urgent request for equipping the Air Defense District Hamburg with 26 water tank trucks was unfortunately only partly filled. Only 6 of these water tank trucks were made available to the district by the Air Defense Command. They remained for a week in Hamburg and were used to supply drinking water during the daytime and for fire fighting during the night. In addition, the power hoses of the army were made available daily for afterhosing work. After the afterhosing work was finished, the decontamination brigades had to be set to work to recover the dead. Later, water tank trucks were required to provide drinking water for the population, the hospitals and the rescue stations that were full of wounded. In addition, the vehicles of the Fire and Emergency Services had to be put in

working order and substitutes for destroyed lodgings of the personnel had to be found.

Air Attack of August 3, 1943

This air attack occured during a severe thunderstorm and therefore the full potential consequences from the attack did not develop. The inner city was the main target although fires were started in Sectors VII and VIII, in the areas of Groups East and Harbor that were relatively quickly put under control. Strong fire fighting forces were therefore sent to the inner city up to the point where no more could be spared from other Sectors. Additional outside forces were again requested by the Police President. For the deployment in the inner city, command posts were established on Adolf Hitler Platz and at the Ganse Market. The areas on fire did not expand and the fires generally were not completely out of control so it was possible to place relatively small damage areas under the responsibility of individual officers. This allowed a planned attack on the fires to be carried out. A total of all forces used in fighting the fires was 260 fire units including all outside units.

During this attack on the Air Defense District Hamburg, the Hamburg Fire and Emergency Service provided 254 serviceable squads that carried out 769 assignments, which included:

in 263 cases fires were extinguished;
in 73 cases fire spread to neighboring buildings was hindered;
in 120 cases the fire was fought and the force of the fire was decreased;
in 278 cases afterhosing operations were carried out;
in 6 cases human rescues were made possible; and
in 29 cases water supplies were provided.

The casualties were relatively light and consisted of: 1 dead, 2 severely injured, 6 lightly injured. One fire engine was damaged.

Further Clean-up and Afterhosing Operations and Work Service

Clean-up work was necessary for a long time. Up to August 25, afterhosing of smoldering fires had to be carried out at different places every day. To provide support until August 7, units of the Air Defense motorized divisions were deployed; and, until August 10, fire fighting units of the Army were available by day. From then, the Hamburg Fire and Emergency Service alone had the responsibility for the afterhosing and clean-up operations. The decontamination brigades later had the prime task, besides that of the removal of bodies from blockaded air raid shelters, of the removal and clean-up of the very numerous phosphorous bombs and their residues. From August 26, 1943 on, half of the Fire and Emergency Service personnel were assigned to provide support to the repair service for clean-up work on the streets that had been littered with debris from explosions and for opening

up debris-blocked shelters. This work continued for several weeks. Substitute quarters had to be located and set in order for use by the Service personnel. In total, 34 billets of the Fire and Emergency Service (including the fire defense police stations 5, 6, 9, and 16, and the equipment storage building in Wandsbek) had been completely destroyed. In addition, 4 billets were heavily damaged and 17 lightly damaged. All vehicles and associated equipment had to be overhauled; all the hoses had to be cleaned, dried and made available for future use. For several weeks, wet hoses had to be reused.

C. EXPERIENCES

1. Leadership and Deployment

a. Command Posts. It was again shown by the air attacks that command posts cannot be allowed to be set up in narrow streets, but instead, must be set up on broad squares or plazas where they can be easily found and where the surrounding square can be used for the disposition of vehicles. On-site command stations must, where possible, be located on large squares or broad streets besides being in the afflicted area. Police service buildings or fire defense police stations, where communications equipment is available for use, are suitable sites. However, an extraordinarily good view of the surrounding area must be possible from such buildings. Available personnel must be thoroughly acquainted with the post. Prepared forms showing strength of forces and their deployment must be available in the posts. Later, such on-site command posts must be well-equipped with motorcycle units and street pilots. Experience has shown the extreme necessity that the on-site command stations be in communication through field telephone cable with superior command posts. From the great number of messages that were sent, it can be proven that damage areas presented on position maps provide a much faster and better view of the situation than notices that are several pages long. A complete overview of the units in action can be obtained in the command stations only if the units report in both upon taking over and upon leaving a fire site. In addition, the larger fire fighting units and the Air Defense motorized divisions should never be withdrawn from a fire site without the knowledge of the other command posts in the area. The division of the larger damage areas into smaller areas or sectors under the commands of individual responsible leaders has always been known to be a desirable method to control the fire fighting.

b. Reconnoitering. The views of tower observers were always obscured shortly after an attack due to smoke and dust. Thus the tower observers provided very little information on the location of fires. Following the breakdown of the telephone connections only a few messages were received at district headquarters. For example, during the air attack of July 24/25 only 7 of 320 fires in the Division IX area were reported. A reconnaissance, if carried out quickly, is therefore particularly important during a mass attack. Most valuable were the reports of the officer patrols that were sent

out by automobile or in motorcycle side cars.

It is better for scouting teams to work in pairs where one officer dictates his observations and the other writes them down. The written observations can then be rapidly delivered to the command station by a motorcycle messenger. A very large number of messages did not arrive at their destination because of tire damage to automobiles and motorcycles. For short scouting distances and for streets covered with debris, bicycles have been found to be a useful type of vehicle to travel on.

To achieve an overall view of the damage situation as quickly as possible after an attack begins or at any time later, it is necessary that the reconnaissance represents the latest viewpoints. For the headquarter command stations the receipt of many messages about isolated burning buildings is worthless. They increase the difficulty of producing a general overview of the situation. What is needed are sober, factual reports without exaggerations giving the actual situation in an area. Such reports can only be expected when proper training of scouts or observers has been accomplished.

c. Pilot Stations. The pilot stations were shown to be unable to cope with the massive numbers of incoming out-of-town fire fighting units. The records concerning such forces passing through were very poorly kept. Above all, the units must be identified by their proper designation. Differentiation was not made, for example, between arriving Air Defense motorized divisions and regular Air Defense Fire Fighting units. Because of this, many mistakes in assignments were made. The number of pilots was, in general, too small. A greater number of pilots must be made available quickly, now that knowledge of the effects of mass attacks on cities is available.

The pilot stations were not always sufficiently recognizable so that many incoming fire fighting units passed them by. It is important that pilot stations be supplied with motorcyclists that can continually check on whether or not the main streets are passible so that necessary detours can be quickly set up.

d. Deployment of Forces. The fire fighting units located within the heavily-attacked areas generally deployed on their own authority and reported the same to headquarters later on. Within the mass fire areas, human rescue was more urgently required than fire fighting, which was set aside until later. Because of this, fire stations in the areas of Divisions IV and V were allowed to burn down.

For the future, it is desired that some squad billets be located in the vicinity of water sources so that in the fire areas the fire fighting units can more easily provide water-spray protection for the rescue of people.

It must also be strongly underscored that the fire fighting units remain as organizational entities so that a stronger fire fighting force be available for

use and so that the transfer of units from one sector to another in the Air Defense District can be carried out more rapidly.

In general, fire fighting operations from within the mass fire areas was impossible since the streets could not bear traffic due to the great amount of rubble on them. For the outside fire fighting units, small damage areas were often given as assignments which allowed them to apprise the local situation themselves and to attack the fires using their own judgment on how to proceed.

Basically, fire fighting operations were carried out only on those fires where something still remained to be salvaged. To accomplish this purpose, all units, local and out-of-town, were made acquainted with the most important buildings in their fire sectors. Upon examination of the records, it is found that most extinguishing of isolated fires took place outside of the mass fire area and that most of the fire fighting inside the mass fire area was to extinguish burning coals (i.e., as afterhosing operations after the mass fires had burned out.)

The isolated power hose units of the auxiliaries were useful only when fires were present in the vicinity of water sources. For other tasks they did not have sufficient hoses. They had to first assemble before they could go into action effectively. A station for such units should be provided and active officers of the Fire and Emergency Service are urgently needed to take command of these isolated units. Many of the non-commissioned officers of these units are not sufficiently energetic for the unit to be effective.

The rapid withdrawal of a unit from a fire site was very difficult because the Self-Protection forces often refused to take over the fire site. Sometimes they would not even take over a site with an almost-extinguished fire that had a few very small fire centers remaining. The training of the Self-Protection forces to take over such fire sites must be carried out very energetically in the future. It is also required that fire watches remain behind in areas that are evacuated to prevent the development of further great fire catastrophes.

The recent proclamation used the expression "main battle line" and it is unsuitable. A better term is "basis line" to represent the location for mounting forays into the fire area to save people and deployments to buildings which may be saved from burning down.

e. Out-of-Town Units. Those outside fire fighting units that are to be deployed have to be made very familiar with previously prepared plans of such a deployment. To redeploy outside forces from one command post to another, the need must be very urgent. Much time can be lost by such actions.

The out-of-town forces perform best when they are made responsible for a specified fire sector. This was possible with the larger fire fighting units. Coworking with these units was generally good. In isolated cases, difficulties arose because the advice and counsel of the experienced Hamburg Fire and Emergency Service commander were not followed. Also permission to exchange a few hoses that were urgently needed at a number of fires was refused. Such incidents as these produced many annoyances and errors that experienced, knowledgeable, and prepared leaders could have avoided.

The value of the volunteer fire fighting units, with few exceptions, was trifling. They had to be put under the command of the hard-pressed Fire and Emergency Service units commanders. Many were a bother because of their very unusual and non-standard equipment. It can be said, in general, that the volunteer fire fighting units know little of fire fighting from the inside of buildings. They were without much knowledge of fire fighting procedures in large city buildings and carried out attacks on the fires from outside (i.e., by "wall-washing") and thereby interfered with useful fire fighting efforts. Similar observations were reported by officers of the Air Defense motorized divisions. It is essential that in the training of these forces more stress should be laid on inside attacks on fires. Many of the out-of-town fire fighting units left fires half extinguished without reporting to their superior command posts.

It is urgently desired that auxiliary forces (for example, the Army) be equipped with shovels at their sites so that glowing coals could be handled. This was especially needed with glowing coals in attics where the coals can rapidly burn their way from one level to another.

f. Equipment. Almost every fire fighting unit complained that too few hoses were carried on the vehicles. The fire fighting equipment was of no use when the distance to water sources was greater than the length of the available hoses. Since the large scale attacks, the equipment of the Fire and Emergency Service has been increased by about 5B hoses per squad. The Alco nozzle has not yet been tested. Heavy duty hose bridges are urgently needed. Every fire brigade has been ordered to be equipped with a heavy duty hose bridge. Everyone misses the water tank trucks for the clean-up work. It has been requested that each fire unit or, at the least, that each Fire and Emergency Service division be equipped with a water tank truck.

The hose bridges used previously were too weak and were destroyed in a short time. Heavy hose bridges slid on the pavement when trucks came past so that a watch over them had to be continually manned. All possible means must be considered in hose laying along a stretch of pavement. The laying of long hose lines from moving motorized hose carriers was simply impossible. The hoses had to be removed from the carriers and carried by hand over the debris.

Open vehicles were unsuitable for driving through burning streets since the radiating heat affected the personnel too much. Vehicles with sail cloth covers also proved to be unusable since the cloth could be set afire too easily.

For connecting field command posts with the headquarters command posts, an automobile equipped with a two-way radio must be made available. Even better equipment would be shortwave transceivers that have been urgently requested. An increase in the permitted number of motorcycles is desired. It has been ordered that every fire fighting squad be equipped with a bicycle so that urgent messages can be delivered more rapidly over debris-filled streets.

g. Provisioning. Provisioning of the units during the first days of the attack was exceedingly poor and could not be carried out due to the destruction of supply stations and supplies. The difficulties were increased because of the constant shifting of the fire fighting units from one site to another. It is hereby proposed that a Division has the duty to refuse to provide provisions to a unit that does not belong to that Division. The units have taken over many provisioning stations of the NSV by demand. It is urgently required that all units be supplied with iron rations. The ideal solution would be to equip each fire fighting brigade with its own field kitchen. In addition, all units should be supplied with bread canisters, water canteens and so on for emergency cases and for use when the unit has to travel a large distance to a fire site. In the presence of the unbearable heat, the supply of drinks to the fire personnel appears to be somewhat more important than the supply of food.

h. The Relief of Units in Action. The orderly relief of units is an urgent requirement. It is well known that, when a fire fighting unit is deployed days on end without a rest interval, it can no longer perform energetic fire fighting attacks. It must be established that out-of-town units should remain deployed during the nights in Air Defense District Hamburg in order to allow some of the local units the possibility of obtaining rest. It has been also observed that the men in the Air Defense police are becoming too old. Younger men can withstand the great hardships much better and should be recruited whenever possible.

A very great hindrance to the fire fighting work was caused by the stream of refugees. They were careless of the laid down hoses on their way past working units. Many of the Fire and Emergency Service personnel had to be used to control traffic and were, therefore, lost to fire fighting duties. The streets often were so congested that fast travel through the streets by the motorcycle messengers with urgent messages was impossible. For the future it is recommended that the stream of refugees not be allowed to pour over all parts of the fire perimeter but that they be led out.

i. Experiences with Self-Protection and Expanded Self-Protection Services. In many places the Self-Protection Forces performed very well and in many other places they did not hold their ground. The forces often withdrew when faced with light smoke clouds. At other places the fire watches were not posted according to plan or remained inactive during the rain of firebrands. They often obstructed the internal fire protection of buildings. They were hindered greatly by eye irritations. Eye protection equipment is required. They were in great fear of phophorus bombs. In many cases, an attack on this fire was not even attempted. A clarification of the possibilities for putting out phosphorus bomb fires is a requirement that is to be vigorously pursued. At several locations bucket brigades were established up to 400 meters long. One could quickly determine if a house had been defended by the Self-Protection Forces. If it had, it did not burn down so rapidly. Within the area where mass fires occurred, defense by the Self-Protection was extraordinarily difficult. In such areas, successful fire fighting by the Self-Protection was the exception. In the days following the passage of the fire storm the forces of the Self-Protection were without spirit and exhausted and could not be moved to undertake energetic fire fighting.* The Self-Protection worked especially successfully where the planned number of men were available. In some buildings fire spread was prevented by the knocking down of overhangs and balconies. Outer and inner doors were often found locked in many cases and had to be broken down.

Unnecessary water damage occured in many places where hoses were used without pressure regulators. The Expanded Self-Protection units must be equipped with regulated hoses. The cooperative work of the forces of the Expanded Self-Protection and the Industrial Air Defense with the Fire and Emergency Services units was generally very good. During the third, and especially during the fourth attack night following the evacuation, Self-Protection forces scarcely existed.

j. Experiences in the Fire Storm. The fire storm began 20 minutes after the first bombs were dropped and reached its maximum level within about 2 to 3 hours later and then decreased in intensity after 5 to 6 hours after attack. The prevailing wind direction did not influence the behavior of the fire storm. From all sides winds were directed into the area of the mass fires. During that time, no prediction could be made concerning the direction towards which the fire might later advance. The powerful winds filled the streets with broken-off tree branches and blown-down trees. It uprooted trees with trunks up to 1 meter in diameter and bent the crowns of younger trees to the ground. The winds were simultaneously very hot and very dry. It was not possible for strong men to work their way against the typhoon. They had to give up after traveling no more than 50 meters and

* No report exists on the number of Self-Protection personnel that were ordered to leave the city after the first attack.

were often knocked over. Firemen could not remain on roofs or on ladders. An extension ladder, for example, could not be held up by 4 men and the ladder and a man on it were blown down. The force of the storm winds easily broke window panes. Doors of dwellings could only be opened if several men pushed against the wind.

In the fire storm roofs of slate and tarpaper over wood fared better than tile roofs. Windows with small panes were more durable than those with large panes. Open areas of less than 150 meters across were often not large enough to provide protection against the heat of the fire storm. Parks that contained stands of bushes were more useful. Water must be available, as well, to keep clothing damp and to make the clothing insensitive to ignition by rain of glowing sparks and firebrands. All officers and non-commissioned officers must keep in mind the basic concepts and methods of human rescue in fire storms.

k. Dynamiting. In view of the large burned-out areas, dynamiting was examined to determine whether it might serve successfully to stop or hinder the growth of the fire areas. Because of local circumstances it was not used since it did not appear that it would serve the purpose. During the storms, it was not evident what direction the fire would expand towards and when it did, the fire spread so fast that the dynamiting, which requires a long time to prepare for, would take place too late.

After the fire storm intensity diminished, the fire again became normal. Buildings burned relatively slowly and spread slowly from one building to another. Dynamiting as a form of fire extinguishing can perhaps be successful if no independent water supplies are available for other types of attack on the fires. In Hamburg during the fire storm these cases did not exist since water for fire fighting was generally available from the Alster, the canals and other static water sources.

2. The Water Supply

a. Measures and Services Before the Air Attacks. The normal water supply depended upon a distribution network that had hydrants recessed below the street but which were made recognizable by white winding lines. It was possible to recognize these lines from far distances at night. The independent water supply for Hamburg was constructed through:

(1) the reclaiming of all available open water sources and by constructions (by means of ramps, platforms to the harbor edge, canals, etc.). In the harbor 29 ramps were constructed from public sources. Dikes and drains (to the outer Alster, Harburg and Altona) were used as emergency sources of open water in the heavily built-up section of the city. In addition, there was the new construction of 3 pressure mains (for St. Georg and Barbeck) from open water to the heavily built-up area.

(2) the use of available wells of industry and in the service buildings. Five artesian wells were constructed from public resources in the "dry" but heavily built-on city area.

(3) the seizure and construction of available containers of all types: swimming pools, water towers, rain cisterns, research waterway of the ship research station (60, 000 cubic meters), fountains, wading pools, sand chests, industrial containers (for example, cooling towers), elevated containers, fermentation tanks, empty oil tanks, gasometer basins (put into operation by suction hose shafts, ramps, etc.). Since 1939, 156 water containers were built from public resources resulting from 3 projects. Of these, 130 had an average capacity of 400 cubic meters. In 2 cases, the cellars of destroyed houses were rebuilt for water supply containers. More water containers have been built by the Army, industry, and lately by the city itself.

b. Course and Measures During the Attacks Relating to Experiences, Proposals, and Questions for the Future. The water supply that depends on the distribution system has completely broken down in a large part of the city during the attacks. In isolated sections the pressure was so low that it could not be used in the mass fire areas. The independent water supply therefore had to be used as the supply of water in almost every case.

The independent water supply of Hamburg is very good because of the numerous locations of naturally available water. In the "dry" sections new construction of wells and water containers greatly improved the supply for those areas. In many cases the endangered population fled to the water sources and were thereby saved from destruction. In the harbor ramps have been built or obtained that can continue to be used to maintain a water supply for the warehouses, their contents and the thickly populated city sections of Wilhelmsburg and Veddel.

The high water pressure connections in St. Georg have been used throughout the days especially to fill the static water reservoirs that have made fire fighting easier. The water pressure connections must be made up of steel piping in the future.

The water reservoirs in the "dry" sectors have been the main reason that fire fighting was possible in those sectors. However, the number of containers are too few and capacity of the containers is too small. A rapid additional construction of larger water containers in the city areas is urgently needed. The containers should be located no farther apart than 250 meters and should hold at least 500 cubic meters of water. Two hose connections should exist on every container or tank so that several fire engines can pump simultaneously. The various water tanks should be made easily recognizable. Some could not be located by out-of-town units.

One water tank was destroyed by a direct hit of a high explosive bomb. Many others have had high explosive bombs detonate nearby but the damages were not sufficient to make the tanks lose their contained water or to otherwise deny its use to the fire fighting crews.

Difficulties were found in refilling many of the tanks. The main problem was the limited supply of pressure hose. The few pressure hose lines that could be laid down often were not sufficient to reach the nearest water source. The pressure hoses, through careless traffic and collapsing houses, were continually being damaged. After the hose supply is increased or replenished and the preparation of more hose carriers completed, filling hoses for the containers from open water sources must be obtained. These filling hose networks were planned for St. Pauli and Altona prior to the heavy air attacks but construction was not begun. The filling hose system for Altona is now under construction (150 mm diameter). For refilling the water reservoir tanks, Lanninger hoses have been recommended. Unfortunately, new procurement of large quantities of this type of hose is no longer possible.

Small wells have proved to be very useful as sources of water. They serve after fire fighting is over as a useful supply of drinking water for the population through use of pressure leads or tank trucks. In one case such a well was for 9 weeks to supply drinking and washing water. Such wells have also served for refilling water reservoir tanks permitting the open water to be treated to protect the population against contagious disease.

Appendix 2

REPORT OF THE TECHNICAL SERVICES DIVISION OF THE HAMBURG FIRE PROTECTION POLICE DURING THE MAJOR CATASTROPHE AND SUMMARY OF REPORTS ON ACTIONS DURING THE AIR ATTACKS ON HAMBURG FROM JULY 24 TO AUGUST 3, 1943

Of the many tasks falling to the Technical Services Division of the Fire Protection Police during a catastrophe, the following three are the most important:

1. Fuel Supply
2. Repair of Vehicles
3. Replacement of Hoses

Below is a summary of experiences gained during the recent catastrophe and suggestions for preventive measures.

I. Preparedness

1. Fuel Supply

The availability of an adequate fuel supply in case of a major catastrophe has been a constant worry of the Technical Services Division since the beginning of the air war in the middle of 1940; it seemed impossible to make it clear to the authorities that the Fire Department had different requirements for reserve fuel supplies than did the general public. Even as late as March 1943, it was possible only under threats to get replacements for the amounts of fuel used during special assignments from the Federal Bureau for Fuel.

Acting on my own initiative, I reached a voluntary agreement in 1941 with the chief of the Hamburg Central Bureau for Fuel and the Official Expert of the County Administration (running counter in part to prevailing laws and regulations) to secure adequate fuel reserves for the Fire Department in case of catastrophe. This agreement guaranteed that fuel could be obtained from various depots scattered all over the city at any time and at a moment's notice. The minimum amounts of fuel in reserve were set at a size sufficient to fuel all units of the Fire Department for ten hours of operation in case half of the depots were destroyed.

In addition, the Fire Protection Police maintained sixteen filling stations at the Fire Stations. Even though the fuel reserves at the filling stations fluctuated greatly depending on the rationing situation of the moment, a sufficient supply was always on hand to fill all vehicle fuel tanks for a five-hour assignment.

Since the filling stations at the Fire Stations were not bombproof and did not lend themselves to the rapid filling up of large fire fighting units, two ideally located large filling stations, one at Sechslingspforte and one at Bei der Friedenseiche in Altona, had been rented by the Fire Department and were stocked with fuel early in 1943.

The original intent to supply the fire fighting units at their duty sites through mobile filling stations had been abandoned in the middle of 1942, based on the experiences in Hamburg itself and on operational activities in Lübeck, Rostock and Bremen, which had shown that due to the difficulties in transmitting messages, the debris-blocked streets, and the rapidly changing assignment picture, this program could have been carried out only with very large manpower expenditures and great numbers of vehicles which were not available in the first place. As a result, the fire fighting units were given standing orders to obtain fuel during prolonged stretches of duty from the nearest fire station. All fire vehicles of the Hamburg Fire Department had at least one reserve gasoline canister, so that the fuel could be obtained with any vehicle of the units without technical difficulties. The Fire Stations, furthermore, had been designated as fuel reserve depots for the Industrial Civil Defense and Expanded Self-Protection plants. In order to fill any gaps in the supply network, the squad workshops of the Technical Services Division had at their disposal special reserves of fuel canisters and drums, as well as the necessary tools to set up emergency filling stations.

All assignments of the Fire Department so far--even including the major air attack of July 27, 1943--did not constitute a real test, however, for the adequacy of the fuel supply during fire fighting activities or for the preparedness measures now in force.

2. Maintenance of Vehicles

While the fuel supply is a deciding factor in the success of the fire fighting, the importance of maintaining vehicles and equipment in working condition does not become evident till after an attack occurs, especially when it is crucial to repair damages as fast as possible. Contrary to widespread opinion, it is not so much a question of obtaining the necessary repair parts as it is of having trained mechanics who are able to recognize the trouble at once and are equipped with the best possible tools. It is not the

primary duty of the mechanics to do major overhauls immediately after a large-scale air attack, and the personnel of the Technical Services Division were trained and equipped with this idea in mind. The necessary equipment for the senior mechanics of the Fire Department to use in servicing portable fire engines in industrial plants and administration buildings had been requisitioned shortly before the catastrophe, but has not been received yet because of the usual red tape accompanying rationing procedures.

The Technical Services Division had at its disposal five excellently equipped repair shops, located at different places in the city of Hamburg. In addition, fourteen smaller, well equipped repair shops were located at the fire stations (though these were not manned around the clock). The firms Daimler-Benz and Klöckner-Humboldt-Deutz, which supply all of the fire vehicles for the Department, also owned well-equipped and well-staffed repair shops in widely separated parts of Hamburg, with a considerable reserve of spare parts.

These technical preparations made it possible to deal with large-scale damages to vehicles and equipment. The fact that the fire vehicles were of such recent vintage--the average age was only about three years--justified our expectations that sudden excess demands on them would have no catastrophic consequences.

3. Hose Supply

Before the catastrophe, all vehicles of the Fire Department were equipped with hoses according to regulations. The emergency reserves of 100 B and 100 C hoses per unit were on hand, although in some cases they were not stored with the units themselves, but were used as exchange reserves by the hose laundries. On the whole, therefore, the hose supply could be described as adequate.

For the repair and care of hoses, hose laundries and hose repair shops were maintained in three of the Technical Division workshops which were staffed around the clock. Two of these had automatic laundry machines. Three other, widely separated, fire stations had facilities for the establishment of auxiliary hose laundries. Furthermore, arrangements had been made with sixteen firms all over the city (public baths, heating plants, drying plants, etc.) where hoses could be dried and cleaned quickly.

Since during various assignments of the Hamburg Fire Department--e.g., when assisting in Lübeck and Rostock as well as during the attacks on Hamburg in May 1941 and July 1942--almost all hose material on the fire vehicles (about 80 km) had been used and thereby experiences had been

gained about the distribution and processing of the required amounts, even a large loss of hose material and the loss of some hose laundries was not expected to lead to important technical or operational difficulties.

4. Supply of Equipment and Uniforms

Reserves of personal and technical equipment were limited in view of the general supply situation. According to previous experience, a large amount of wear was to be expected on jet hoses, distributors, stand-pipes and boots. The reserves collected for this purpose had been distributed in various locations and stored in firebomb-proof places. Negotiations for a storehouse outside of the city of Hamburg were in progress but had not been concluded when the catastrophe took place. This storehouse was not used until the middle of August.

II. Actual Situation During Catastrophe

1. Fuel Supply

The first major air attack, on July 25, 1943, caused no difficulties in fuel procurement. The larger out-of-town fire fighting units that wanted to take gasoline by unit were rerouted to the large filling station at Billwärder Steindamm and were quickly filled up by automatic gas pumps. The filling station at Fire Station 9, which was heavily bombed during this attack, fortunately remained usable. The gas station attendant remained on duty throughout the action in a parked automobile in the midst of smoking ruins.

The second air attack, on July 27/28, caused a great deterioration in the fuel situation. Enemy action caused the destruction of the important gas stations at Fire Stations 5, 6, and 16, along with the loss of their fuel supplies. Also destroyed were the major gas stations intended for use in a catastrophe in the districts Hammerbrook, Rothenburgsort and Borgfelde. The approaches to numerous other filling stations were blocked by debris or were not passable because of the presence of delayed-fuse bombs or danger of collapse of damaged buildings.

In addition, many of the fire fighting units from out-of-town, in particular the volunteer fire departments, left their home quarters without the necessary fuel reserves, and the first thing they did on arriving in Hamburg was to present their special gasoline ration cards which were of little use in the situation which prevailed at the time, and ask for fuel. Also many of the out-of-town units had resolved to return home with more fuel than they had left with which further spurred them to ask for gasoline. Unfortunately, the fuel supply of the Civil Defense Motorized Divisions--which according to prevailing regulations were supposed to procure their own

fuel through air force channels--was not up to snuff, apparently due to the prolonged period of assignment. Nothing or very little was done to alleviate the arising shortages with Armed Services supplies; rather the Civil Defense Motorized Divisions were simply referred to the Fire Protection Police for their fuel needs. The supplying of such large units with fuel by hand pumps--aside from the enormous quantities of fuel needed--tied up the pumps for hours at a time, even in well organized filling stations.

Despite the above difficulties, the fuel requirements after the second attack were fully satisfied without interruption by using every available facility and all available transportation. The Central Bureau for Fuel assigned out-of-town tank trucks to keep on refilling the pumps at the filling stations according to orders by the Technical Services Division. By the way, great praise is due the Central Bureau for Fuel for the unbureaucratic, quick and competent way in which it discharged its duties. The Fire Protection Police, on their own, had taken over the transport of Diesel fuel from the German Vacuum Oil A.G. in Wedel with their own vehicles. Furthermore, a number of abandoned but still serviceable and well stocked filling stations were discovered by special reconnaissance, amongst them the large filling station at Billwärder Steindamm, at which approximately 80,000 liters of Diesel fuel were stored.

The following will serve as an illustration of the difficulties encountered in fuel distribution: The approaches to the Billwärder Steindamm filling station were hopelessly blocked. After about 100 dead bodies had been removed--among them the bodies of the filling station civil defense personnel--it was possible to clear the debris from the approach. Although the station itself was little damaged, a delayed-fuse or time-bomb lay in the middle of the yard in front of the gasoline pumps. The speedy removal of this time-bomb was immediately ordered from Local Headquarters. A few hours before the third attack, the bomb was removed and the sergeant of the demolition squad declared the station safe. During the third attack, however, the station was heavily attacked and this time important parts of the gasoline station were damaged and the approach, which had just been cleared, was more severely blocked than ever.

The third and fourth air attacks brought no increase in fuel requirements. After the out-of-town units had left, fuel distribution was handled by the fire stations almost on a peacetime basis, and the filling stations were kept stocked by tank cars of the Central Bureau for Fuel. The major filling stations at Sechslingspforte, and at Bei der Friedenseiche in Altona were in constant operation until August 11, 1943. These stations more than fulfilled the expectations of the Fire Department at the time of rental. Both of these stations were located in the midst of a totally destroyed area, but still sufficient approach possibilities were available and the stations

were ideally suited for the servicing of the vehicles of the larger fire fighting units.

At no time after the first major air attack did a shortage of fuel arise. The waiting times caused by the traffic jams at the filling stations were unavoidable. The following laconic note appearing in the report of the Motor Officer of the Berlin Fire Department: "Fuel was received without delay at the Main Fire Station Hamburg..." should illustrate the smooth functioning of the fuel distribution system. As for the lubrication oil supply, on the other hand, on July 29, 1943, several lengthy delays occurred for supplies because no central bureau had been set up for the distribution of lubrication oil; also, most of the usual suppliers of lubrication agents for the Fire Department had been obliterated, and out-of-town supplies had to be requisitioned through motorcycle messengers. The current needs of the Fire Protection Police for lubrication oil are being satisfied in full through the German Vacuum Oil A. G. in Wedel.

Altogether, from the evening of July 25 to midnight of September 30, the following amounts of fuel were disbursed by the filling stations of the Fire Protection Police:*

217, 900 liters of gasoline
149, 000 kg of Diesel fuel
7, 965 kg of motor oil

2. Maintenance of Vehicles

Because almost all personnel were assigned to dispensing fuel up to the third attack, no repair work of more than one hour's duration could be undertaken on fire vehicles. Available personnel were assigned, without exception, to repair damaged tires. Until August 5 about 400 tires were patched at the Main Fire Station alone. All patching material reserves, which had been stored because of the experiences in the Ruhr district, were used up. The air pressure hose--probably the only one in operation for kilometers around--was in constant use. The damages to tires of the fire vehicles fortunately remained within reasonable bounds. Most of the tire damage occurred on passenger automobiles and motorcycles. Unfortunately, much of this latter damage was beyond repair because the driver often wanted to keep going over the debris-filled streets despite damage to his tire. Damage caused by nails was rare, but cuts made by glass and steel splinters were frequent.

* From July 25 to August 3, the amounts were: 87, 075 liters gasoline, 65, 574 kg Diesel fuel, and 3, 109 kg motor oil.

Clutch damage was the most frequent cause of vehicle failure (perhaps due to continuous driving in low gear across debris; also excitement!) Cylinder heads were also often damaged. Damage to portable fire engine pumps was frequently caused by improper mixture of gas and oil, probably due to hurry and excitement while preparing the mixture for refueling. Also some LF 15's which had not been properly broken in, failed, probably because of over-heating of bearings and packings. One special case should be cited here: One LF 25 was filled with foam instead of gasoline by mistake and to remove the foam from the oil filter and fuel pump took several hours of work.

The following table gives the number of vehicles lost during the four attacks:

		Destroyed Vehicles			
LF 8	LF 15	LF 25	H&L Trucks	Hose Trucks	Portable Engines
5	5	15	3	5	4
		Damaged Vehicles Needing Major Repairs			
7	22	12	7	--	18

Repair of severely damaged vehicles still presents difficulties at this stage, because all repair shops working for the Fire Department, with the exception of Daimler-Benz (e.g., Klöckner, DKW, Opel, Bosch) have been destroyed, as have all wholesale spare parts firms. Daimler-Benz is trying to set up an emergency operation in its partially destroyed repair shop. After a precise inventory of needs has been completed, the necessary spare parts should be ordered directly from manufacturers.

3. Supply of Pressure and Pump Hoses

Considerable amounts of hose material burned along with their respective vehicles. Also some of the reserve hose materials went up in flames together with the fire stations in which they were stored. Constant collapse of walls and large-scale withdrawal operations of the fire fighting forces involved further losses of large amounts of hose. Also large losses of hose material were incurred by the tearing of the hoses at the coupling joints. Of the 37 km of damaged hose material running through the hose laundries from July 25 to August 15, more than 80 percent had torn couplings.

During the first three weeks after the catastrophe, only damaged hoses were turned in to the hose laundries by the units. Usable wet hoses remained on the vehicles, or else they were dried by the units themselves. The warm dry weather was a great help in this respect.

The reconditioning of the used hoses--the ones that needed repair first--was slowed by the loss of hose laundries at Fire Station 16 and in Wandsbek. Also numerous auxiliary drying rooms in various plants had been lost. Despite these handicaps, 10, 385 lengths of pressure hose; i.e., a total yardage of 186 km, has been repaired in the hose laundries of the Fire Protection Police.

After the second major air attack, 1000 pieces of B hose were delivered to the Fire Department from the Civil Defense Supply Depot at Bremen-Grohn. An additional 3000 pieces were supposed to be supplied from Berlin. These, however, never arrived despite much telephoning and telegraphing. Finally, small amounts of B and C hose were received from the Civil Defense Supply Depot at Rissen.

The following table gives the number of destroyed hoses:

B-Hose	C-Hose	Pump Hose 2.5	Pump Hose 1.6
2, 680	1, 740	182	124

At present, nearly all fire vehicles are operating with wet hoses. Procedures to dry and repair the damaged hoses and exchange them on a brigade-by-brigade basis for used hoses turned in, have been set in motion. (All units still on active duty at the present time have their full supply of hoses, albeit wet ones in most cases.)

The drying and repairing of hoses is hindered by the destruction of large hose laundry installations at Fire Station 16 and at Wandsbek, as well as by the loss of drying sheds in plants and public buildings that had been set up originally for thawing out hoses in the wintertime. The units are therefore trying to do their own hose drying.

4. Supply of Equipment and Uniforms

The loss of equipment, especially hose mountings, was extremely high, and we did not even come close to replace all losses from existing reserves. Most of all, stand-pipes, distribution joints, hose bridges, jet hoses, and harpoon lines were destroyed by falling debris during fire fighting operations or else were lost during withdrawal operations.

According to reliable information received so far, there was a loss of about 10, 000 pieces of equipment of all kinds (including tools).

The repair of boots was the primary task with respect to personal equipment and uniforms. A sufficient supply of leather was available (although 2000 pairs of shoe soles stored in the air raid shelter of Fire Station 9 were destroyed by a direct hit!); however, all major shoe repair shops, including the City Workshops for the Indigent, were destroyed. The shoe repair work which before the catastrophe was distributed throughout the city was left to the fire fighting units to accomplish; they either established their own repair shops manned with their own men, or commandeered services from the smaller shoe repair shops. By the end of August, all difficulties in this regard had been overcome and all boots had been repaired.

The store linen and clothing in the supply depot was first issued to those firemen (about 300 men) who had been bombed out so that they would at least have one complete uniform after having lost all their belongings. In cooperation with the Police Quartermaster, additional clothing has been obtained from the clothing depots of the Berlin Police Department so that all bombed out personnel could be issued a second complete set of uniforms, and so that other lost clothing could be replaced.

III. Experiences Gained from the Catastrophe

1. Fuel Reserves

To secure the necessary fuel reserves based on the experiences from the major catastrophe, the following measures should be put into effect immediately:

a. Every vehicle of the Fire Department (except motorcycles without sidecars) must carry at least one full reserve fuel container in order to release the unit lead brigade or the Headquarters staff from responsibility for fuel supply during the first few critical hours of a catastrophe. Having this extra reserve along also secures the journey of large units over long distances (e.g., from Berlin to Hamburg) without having to waste precious time filling up at service stations (especially during the night!). This would also have the added advantage of providing containers for fuel brought to the fire sites, for it had been observed during the catastrophe that few or no fuel containers were available to put gas in, which had serious consequences for the fire fighting operations. The procurement of the necessary containers--they do not have to be uniform--must be initiated by Headquarters because of the priority situation concerning raw materials.

b. Filling stations within city boundaries have very limited value. Efforts should be made to secure the large filling stations at the periphery of the city, which are now mostly closed down, for use by the Fire Department. Such stations would be most suitable for servicing large units, would take some of the pressure off the city filling stations, and would keep the few remaining traffic routes free of parked fire unit vehicles whose traffic discipline, even in Hamburg, left much to be desired (lack of leadership!).

c. A permanent filling station with underground fuel tanks is the best guarantee of an adequate fuel supply, because any storage of large amounts of fuel in barrels or other containers above ground always carries great danger of loss. It should be taken into consideration that filling up with the usual hand pumps takes a considerable amount of time. If it is possible, however, to increase the fuel reserve on the vehicles by obtaining the necessary spare containers, this drawback should not be very crucial.

d. Considerable amounts of fuel were stored in underground containers at gasoline refineries; however, this supply could not be utilized because the gasoline pumps were damaged. In some cases it was possible to remove the fuel through use of fuel tank trucks with built-in pumps. The Central Bureau for Fuel should be acquainted with the whereabouts of these fuel tank trucks. It would be desirable to have a tank truck of this type put at the disposal of the Hamburg Fire Department for catastrophes; it could serve at such a time as a mobile emergency filling station.

e. Tanking-up must be carried out with strict discipline; otherwise, traffic jams will develop in no time. In order to keep track of the amounts of gasoline dispensed and the units serviced, a simple log book to be signed on receipt would be sufficient.

f. Out-of-town units must carry sufficient fuel supply from their home quarters for 48 hours of continuous duty (not stand-by time!) or else must have arranged for replenishment from outside the area of catastrophe. These units should be urged to satisfy all their fuel needs without assistance from the locality of the catastrophe.

g. It has to be impressed on the fuel rationing boards that different criteria must be applied to the fuel reserves for fire fighting than for the general economy. The drive for an increased amount of motorized fire engines which has been underway for a few months is completely useless unless fuel supply for these vehicles for at least the first six hours of operation is absolutely guaranteed without red tape or any kind of paperwork. It is understood that this requirement has considerable consequences

for the general rationing of fuel; however, it seems completely senseless to deny the soundness of these measures in view of the devastating economic consequences of conflagrations which are allowed to spread unhindered, and to defer action on them.

2. Maintenance of Vehicles

Based on the experiences from the catastrophe, the following measures are required to guarantee the proper maintenance of all fire vehicles:

a. New fire vehicles with built-in pumps must be driven for a distance of at least 1000 km to break them in. The saving of fuel accruing from not following this procedure is only an illusionary one, because the failure of these vehicles just in the most critical time during fire fighting operations is more serious than any expenditure of precious fuel. The unavoidable heavy motor damage may mean weeks or even months of being out of commission with today's replacement parts situation. The directive to break in vehicles only during duty calls is meaningless for fire vehicles because the latter are not being used for transport purposes because of their mountings. An exception has to be made for fire vehicles, therefore, in the interest of keeping them ready for an emergency. The same, of course, applies to portable fire engines.

b. The availability of replacement and repair parts is of utmost importance to continued performance of the fire fighting units. According to present regulations, the procurement of replacement parts for fire vehicles is a cumbersome and time-consuming process. While motor parts can be obtained without too much difficulty, the replacement parts for the special equipment of fire engines (e.g., pumps) must be requisitioned from the supplier using official order blanks of the Fire Protection Police, which in turn after checking the requisition passes it on through official channels; in other words, it takes weeks until the requisition even reaches Berlin. Aside from this fact, the supplier firms apparently do not have reserves large enough or complete enough to be equal to the demands of the air war. Every effort should be made to have large repair shops of private firms or municipal contractors carry sufficient repair and replacement parts on hand, including those for fire vehicles, for the area assigned to them. There is no reason why this task cannot be accomplished without either technical or legal bureaucratic delays. During the present drive to boost the number of vehicles to the highest amount possible, proper maintenance and care of the already existing vehicles must not be overlooked!

c. A large number of damaged rods and pistons occurred on the two-cycle engines, apparently due to improper lubrication. The two-cycle

motor is very simple as far as construction and maintenance is concerned. The proper gasoline and oil mixture seems very simple too; however, it presents difficulties during and after an air raid (the oil is often completely forgotten, the oil-gas ratio is calculated incorrectly, etc.) sothat it appears necessary to make sure of the correct lubrication mixture ahead of time.

d. Trouble with the fire pumps was limited to three areas: the ventilating pumps (dampers!), the axle-shaft seals, and the shut-off valves. All three types of trouble severely reduce the suction cap ability of the pump. These damages are primarily a question of replacement parts (see my remarks under 1), and it is to be hoped that the new standard pump will have eliminated these shortcomings which seem to be pretty general with all manufacturers. Fire pumps must be constructed so that they do not require any maintenance during a 48-hour run!

3. Maintenance of Hoses

One fact emerged from the experiences during the catastrophe which is of such overwhelming importance that it should be mentioned here all by itself: Of all damaged hoses, especially B hoses, 80 to 90 percent had a torn coupling joint. This weakness has been known for a long time and is caused by the inelasticity of the ersatz rubber and plastic used in manufacture. Unfortunately this shortcoming cannot be compensated for by the good quality of the binding. Lengthening the neck of the couplings will improve the coupling joint considerably with a comparatively minor increase in material used. The practical execution of this measure must be implemented without further delay, as it is of the utmost importance!

4. Maintenance of Equipment

Among the most frequently damaged parts of the hose mountings are the distributors. The cumbersome valve shaft bent or broke under the slightest pressure. This renders the distributor useless and replacements are almost impossible to obtain because of the many different makes. This shortcoming--which has been observed on previous occasions--should indicate the necessity of an intensive search for shockproof distributors as well as for replacement parts. The parts of the various manufacturers should be standardized and interchangeable!

Pumps were often severely damaged because, when operated without the use of a filter, coal fragments, pebbles and wooden particles were sucked into the pump destroying its rotors. The reason for not using the filters was that when the regulation filter was used, the water could not be sucked up completely from containers (or from cellar floors!). Action of the

non-return valve causes leaking. Since pumping to dryness in many situations is a primary task of the fire fighting forces, and since often the last drop of water is crucial, the possibility of operating without the non-return valve altogether should be considered. Further deciding factors for efficient pump operation would be improved water flow and simplified servicing.

The technical experiences concerning the vehicles and equipment of the Fire Protection Police during the catastrophe days--as well as during earlier assignments--can be summed up in one simple sentence: Fire vehicles must be simple, sturdy, and easy to service!

Instead of scoffing at the lessons learned from practical experience, which has been the case up till now, serious attention should be given to the above plain and simple request!

(Signed) Brunswig, Captain of FPP

Administration of the Hanseatic City of Hamburg
High Command of the Fire Department
Berliner Tor, Hamburg 1 October 4, 1943

The Police President requests the following reports about the air attacks on Hamburg during the time from July 24 to August 3, 1943. The reports should contain the following:

Measures and precautions prior to the air attacks

Course of the attacks as well as experiences, suggestions, and ideas for the future

The report should contain everything that is noteworthy in connection with the air attacks.

TO: 904, 914, 92, 93, and 94 for further action.

Deadline: October 7, 1943 (Signed) Lt. Colonel of FPP

SUMMARY OF REPORTS ON ACTIONS DURING THE ATTACKS

1. Assignments of Hamburg Fire Department Personnel during the Air Attacks from July 25 to August 3, 1943

To fight damages caused in Hamburg by enemy action, the units of the Fire Protection Service were assigned to 6, 196 different damage sites during the four major air attacks from July 25 to August 3. Assignments and successes achieved are distributed among the four attacks as follows:

1. From July 25 to 27, 321 squads completed 2, 346 assignments as follows:

a. In 1028 cases, the fires were extinguished so that the buildings in question could be partially preserved.

b. In 519 cases, the fire was fought and diminished in size.

c. In 255 cases, spread of the fire to adjacent structures and to the general vicinity was prevented.

d. In 445 cases, after-hosing operations were carried out on the days following the attack.

e. In 42 cases, thanks to vigorous and courageous action by the firemen, rescue of human lives was accomplished.

f. In 57 cases, valuable equipment or material was safeguarded or successfully recovered.

2. In the time period July 28-29, 266 squads carried out 1, 430 assignments as follows:

a. In 528 cases, fires were extinguished, so that the buildings in question could be partially preserved.

b. In 286 cases, fires were fought and diminished in size.

c. In 113 cases, spread of the fire to adjacent structures and to the general vicinity was prevented.

d. In 325 cases, after-hosing operations were carried out until July 29.

e. In 86 cases, through vigorous intervention of the firemen, successful human rescue actions were carried out.

f. In 38 cases, valuable equipment or material was safeguarded or successfully recovered.

3. From July 30 to August 2, 1, 680 assignments were carried out by 235 squads as follows:

a. In 554 cases, fires could be extinguished so that parts of the buildings could be preserved.

b. In 293 cases, fires were fought and diminished in size.

c. In 194 cases, spread of fires to adjacent structures and to the general vicinity was prevented.

d. In 568 cases, after-hosing operations were carried out until August 2.

e. In 11 cases, successful human rescue was achieved by vigorous intervention of the firemen.

f. In 60 cases, valuable equipment or materials were safeguarded or successfully recovered.

4. From August 3 to 4, 225 squads carried out 740 assignments as follows:

a. In 263 cases, fires were extinguished so that parts of the buildings could be preserved.

b. In 120 cases, the fires were fought and diminished in size.

c. In 73 cases, spread of the fires to adjacent structures and the general vicinity was prevented.

d. In 278 cases, after-hosing operations were carried out.

e. Five human rescue operations were successfully carried out.

f. In one case, valuable material was recovered.

The decline from 321 active squads to 225 was the result of both the loss of men and of vehicles.

2. Losses Incurred and General State of Health of F. D. Personnel

At the time of the attacks, total Fire Department strength stood at 3, 565 men. Full complement would be 3, 693. The following losses were incurred:

	Dead	Wounded	Missing
Firemen	7	38	1
Civil Defense Policemen	34	109	13
Total	41	147	14

The missing must be considered dead by this time, since zealous inquiries at all possible out-of-town hospitals have not turned up any information to the contrary. The number of Fire Department killed, therefore, would be 55.

A state of exhaustion made itself felt soon after the first attack, since many units were on duty for 36 hours without food or drink. Sometimes the men had to forage for their own food, since no provisions could get through to the firesites. Reactions to the superhuman physical efforts

expended often did not set in until four or five weeks afterwards. Common symptoms like general debilitation, palpitations, headaches, dysentery, etc., were in most cases caused by nervous exhaustion.

The present state of health of the crews, taking into consideration the relatively advanced age of the Civil Defense Policemen, may be described as generally satisfactory.

3. Assignments and Conduct at Damage Sites

Every member of the Fire Protection Police, without exception, was on assignment during the attacks. At first, assignments took place through the Air Sector Command Posts, a squad at a time, as planned.

The enormous number of high explosive and firebombs and the relatively large number of air mines caused, in addition to great demolitions, widespread fires which quickly turned into conflagrations. Debris, craters, fallen trees, broken branches, drooping streetcar wires, jet flames leaping to the middle of the road, and fire storms made street passage in the fire areas near impossible. Smoke and dust darkened the streets to such an extent that on July 25 it remained dark until 9 a.m. Vehicles of whole units sometimes could not be moved and the crews had to abandon them to flee for their lives. To illustrate the extent of the difficulties, it was not possible even during the first attack night to get fire fighting forces to the City Hall (the local governmental Headquarters site) even though a special officer had been assigned to facilitate their approach. Also large factories located in the middle of conflagrations could not be reached in time to protect them from destruction.

The fire fighting units quartered in the damage areas assigned themselves to fire sites (a procedure that worked out very well). In most cases, orders transmitted by motorcycle messengers arrived too late finding the units already on assignment. In some cases, the units ceased operations at the fire site and followed the new orders. Some units were reassigned too late to save buildings; others remained much too long at any one fire site. The assignment of fire fighting forces by unit commanders in the fire sectors assigned to them worked very well. False alarms occasionally directed fire units to fire sites where the fires had already been extinguished by Self-Protection or Industrial Civil Defense units, but such occurrences were considered inevitable.

Fire fighting units from Berlin were assigned singly to different sectors for several days at a time, a procedure that was proved satisfactory. No clear picture of the damage areas was available at headquarters at any given time for the assignment of out-of-town forces.

When the second attack began, a great many fire fighting units were busy with after-hosing work in Group West, and the dismantling of the long hose lines took a long time.

Because of the very large number of fire sites it was impossible to fight all fires. Therefore, in one sector during the first attack, only 77 out of 150 fires could be fought. The assignment log could just barely be kept up. During the second attack, in the same sector, forty new fires developed, of which only 32 could be fought. During the third attack, about sixty percent of the total sector area was hit.

Attempts to extinguish the fires at Fire Station VI and vicinity during the second attack had to be abandoned in order to save human lives. Hedgehog positions were taken up at open water sites and jets of water from the hoses were sent into the streets in order to rescue people from shelters; at times, force had to be used to remove people from their shelters. Some F. D. units concentrated on human rescue exclusively. As a result, Fire Stations V and VI burned down. Fire fighting efforts were greatly hindered by passing trucks and passenger automobiles loaded with refugees. The fire fighting crews that had to be assigned to regulate traffic and to barricade streets were lost to fire fighting work. Occasionally, whole units occupied themselves with the salvaging of linens, furniture, groceries, and other goods as well as with the rescue of trapped persons long after other forces had been assigned to these tasks. The main task of these units should have remained the fighting of fires.

The fighting spirit of the crews flagged as a result of the uninterrupted stretch of duty lasting several days and nights, which greatly overstrained the physical strength of the personnel. All out-of-town forces, except for the Berlin units, were pulled out of Hamburg during the nights, so that the Hamburg forces bore the main fire fighting burden during the attacks. The local fire fighting forces therefore were no longer physically fit when new attacks began. The fire hoses were used, but vigorous attacks on the fires could not be sustained. Whole units apparently took a rest after an assignment was completed. During the attacks it was again demonstrated that many of the fire fighting personnel within the Civil Defense Police are too old for such vigorous tasks and younger men are absolutely needed. The conduct of assignments had to be supervised continuously by the officers. After the fire storm, all available trucks were assigned to the Decontamination Service for the recovery of bodies.

4. Volunteer Fire Departments

A big drawback in the operations with these units proved to be the non-uniformity in the type and amount of equipment available to the volunteer

fire units. In addition, the volunteer crews were not familiar with fighting fires from within buildings and had no previous experience in fighting fires in large city apartment houses. These various fire squads would have had to be instructed first to perform such operations. Apparently many were combined into fire units for expediency. Training for proper performance is necessary. In many instances, fire squads frequently went to work at sites not according to their orders, or else they were intercepted on their way by Fire Department officers on the street who assigned them elsewhere. Also, some of these units left fire sites without signing off or without arranging for continued surveillance of the fire site. At some places, fire engines stood around waiting to be put into action, while at other places whole residential blocks went up in flames.

5. Other Out-of-Town Forces

Complete fire fighting units could be piloted through the affected areas to fire sites only with the greatest difficulty. At times, the Civil Defense Motorized Divisions disappeared without signing off or arranging for continued surveillance at fire sites. However, the Civil Defense Motorized Divisions and Hamburg Fire Department Divisions worked well together in numerous instances. Differences arose only when the orders of Fire Department Division Chiefs were disregarded by the Motorized Divisions. Delivery of hoses at some sites was refused. Also, the failure of some of the out-of-town units to report on and off duty made a survey of the number of assigned out-of-town forces extremely difficult.

6. Self-Protection, Expanded Self-Protection and Industrial Civil Defense

The Self-Protection forces worked well at some damage sites. You could see at a glance if a house had been defended by Self-Protection (it was not burned down as far). On the periphery of the catastrophe, Self-Protection forces held several buildings all by themselves. Bucket chains, up to 400 meters in length, were formed. On the other hand, Self-Protection fire defense within the region of the conflagrations generally proved to be impossible. Only in very rare cases was any success achieved. The Self-Protection crews were exhausted and dispirited in most instances. Even after the fire storm had abated and on the days following, they could not be persuaded to renew their efforts. At numerous sites, Self-Protection forces were not present even on July 25. In some warehouses and storage buildings the Self-Protection forces failed completely, and in some cases they left their posts as soon as slight smoke began to form. Successes were achieved by Self-Protection people mostly in those cases where the crews had been well instructed and technically trained in fire fighting methods. For example, at one building, the Self-Protection crew

broke open the floors at the firewalls in all stories and exposed the beams which led through the firewalls so they could more readily extinguish fires in the beams. In many cases, the crews were handicapped by eye inflammations (eye protection is needed here). Also phosphorus bombs forced them to retreat.

Self-Protection forces, who worked in the attic or on the roof were often cut off from escape to lower floors and perished in the flames. In many such cases, stored lumber had not been properly removed according to regulations. In some cases, the Industrial Civil Defense Squads sprayed water through the windows from the outside without success. At other locations they worked well from inside the buildings and achieved success, particularly where water storage basins were located in or near the plant.

In one essential plant, the ICD Chief with his motorized fire engine squad had been pulled out and only the caretaker and three fire watches were left, and these four were in the public air raid shelter outside of the plant. The fire fighting crews had to break down the gate to get in.

In many cases, gates, front doors and apartment doors were locked and had to be broken down. Toll gates were found locked and where the locks were heavy, breaking them open required a lot of time. In one warehouse a wall was broken through as the fastest way to get in to the building. Shrapnel- or bomb-proof walls afforded good protection for fire guards but they were not generally being used; protective locations such as door niches and corners of rooms were preferred by many.

In some instances, the Expanded Self-Protection crews worked very well. As in every other situation, all they needed was an energetic and courageous leader in order to achieve success. Among many other buildings, a large hotel, a cinema, and several large business buildings were saved through the all-out efforts of these fire fighting crews. Of course, where there was lack of water or of hoses, even the most strenuous efforts were in vain.

During the third and fourth attack night, Self-Protection, Expanded Self-Protection, and Industrial Civil Defense personnel were practically nonexistent. Fire watches were not posted as planned; most looked on and did not pay attention to the flying sparks. Otherwise many a warehouse might have been saved.

7. General Observations

Experience showed that the Pilot Stations for the out-of-town forces were located too far into city territory. Also the number of available pilots

was too small. It is suggested that the pilot stations be moved further out to the periphery of the city. The main traffic arteries must be checked by motorcycle patrols at all times to determine if they are still passable. Logs of units piloted into the city must be kept according to regulations.

The Hamburg master plan for assigning out-of-town forces proved very satisfactory. Consideration is being given to sending officers to the pilot stations to draw up the assignment plans for the incoming forces.

Command Posts must not be set up in narrow or side streets. They must be plainly marked. Also they must have adequate parking facilities for vehicles. Keeping the logs of assignments and reports was most difficult. Sufficient experienced personnel must be on hand for this purpose (with provisions for absentees). Also, all motorcycle messengers must be on duty.

Fire vehicles in some cases were overloaded. In one instance, six B lines were laid from one truck. As a consequence, there was not enough water pressure to fight the fires. Hook and ladder trucks worked very well as water towers at some fire sites.

Vehicles must not be parked in narrow streets during attacks. Even on wide streets, they must be spaced at least 60 meters apart. After passing through damage areas, they must be checked for phosphorus drops, because these do not ignite until some time later when they become dry.

Hose trucks should be assigned to crucial points without special request. Long hose lines could not be laid by hose trucks in many of the streets because of the heavy debris. Experience has shown that the Civil Defense Police, just like the Civil Defense Motorized Divisions, should have a hose truck accompany each fire brigade. Hoses frequently tore at the connection points. The connecting link was too short. Many hoses burst because they were used too much. Hose reserves were completely exhausted after the second attack.

Fire vehicles were not equipped with enough hoses. Five additional B hoses should be carried. The units already carried greater amounts of B hoses on their own during the attacks.

There were not enough hose bridges available; the ones on hand were too weak and were destroyed within a short time. The most advisable procedure is still to open the pavement. This should be done more often. Every fire vehicle should carry two heavy hose bridges. The hose bridges were frequently pushed aside when driven over. Watches should be posted to prevent this.

Plastic nozzles were useless. Various kinds of protective goggles did not stand the test of use.

8. Communications, Reconnaissance

Communications were extremely difficult due to the failure of all telephone lines of the Civil Defense administration (except for a few Fire Department lines, which also were interrupted from time to time). Messengers and scouts had a hard time making progress on assignments because of debris of all kinds in the streets and some streets being blocked by large fires; often, a short scouting trip took hours to accomplish. Many times the motorcyclists were thrown down in the streets after hitting debris which they could not see when the visibility dropped to zero due to heavy smoke. Also, on some nights the strong fog made reconnaissance missions a nightmare to carry out. To illustrate the difficulties of such missions, it is known that in Air Sector IX, only seven out of 320 fire sites were reported. The fire storm winds often prevented fallen motorcycle messengers from righting their cycles. A large number of motorcycles were lost in such fires.

Tower watches became quickly useless because of the smoke; their reports were inexact or wrong and led to false alarms. Immediate reconnaissance is of the utmost importance during an air attack, but because of the debris in the streets, such actions take too much time. It is expedient to take motorcycle messengers along, who can deliver messages as the reconnaissance proceeds.

Large police radio trucks were used, which relayed messages from Group East to Headquarters. It would be a good idea to equip all of the fire fighting units with radio cars.

9. Experiences During the Fire Storm

The fire storm, which at times took on hurricane proportions, started during the second attack (July 27/28) about 20 minutes after the bombs began to fall, and reached its greatest intensity after about two or three hours. It abated after about five or six hours (in Hammerbrook). It was not influenced by the direction of prevailing winds. The force of the storm can be gauged by the fact that trees with trunks of one meter in diameter were uprooted, the streets were littered with torn tree branches, and the crowns of young trees bent down clear to the ground. Strong men often found it impossible to advance against the storm; they gave up after 50 meters or so, and many times they were thrown to the ground. Motorcycle messengers who had fallen down were unable to right their motorcycles. Fire vehicles had to be abandoned by their crews. Fire crews

could not remain on the roofs. Window panes were shattered and a stream of scorching hot air, mixed with sparks, would rush into the rooms. It was often impossible to open entrance doors of apartments because of the force of the storm. One extension ladder could not be held up by four men and the man on the top fell down along with the ladder.

The surface air within the area of the fire storm was both very hot and very dehydrating. The hot air and high wind made breathing so difficult that many people suffocated, or burned to death in the streets. For instance, in Hammerlandstrasse hundreds of persons who had tried to escape the fire storm, perished in the streets. In many cases, tenants remained in the air raid shelters in the mistaken belief that they were safe from the fire storm. Houses with beamed ceilings burned down to the cellar and the occupants of the shelters were killed. Others were prevented from fleeing because the exits and wall breakthroughs were blocked by debris. In some air raid shelters, even public ones, the people were prevented from leaving the shelter by the air raid wardens, and as a result, all perished. On the other hand, people were evacuated from many shelters by members of the Fire Department, often by use of force, and were taken to places of safety. Some people were found unconscious and were revived by oxygen apparatus.

Approximately 18,000 people were saved by the Fire Department during the attack days. Many found shelter at the Main Fire Station where they were given first aid and transported to safe places as soon as possible. Even an emergency delivery took place. The young mother received the first baby clothes from among the Fire Department personnel. Everything possible was done to help people. It should be reiterated here that shelters must have sufficient water and sand. Many people would have escaped death if their clothes could have been soaked in water. Also, no flammable materials should be present in air raid shelters.

Slate roofs and tar roofs fared better in the fire storm than did tiled roofs. Windows with small panes were safer than large plate glass windows.

Open squares or plazas up to 150 meters in diameter did not afford protection from the fire storm. The safest were large parks with lots of bushes. Also water had to be available to keep dampening clothes.

In conclusion, it should be emphasized that all officers and noncoms of the fire fighting and emergency forces be thoroughly indoctrinated with the philosophy and methods of human rescue.

10. Provisioning

Food distribution failed completely during the first 24 hours. Most of the units received no food at all. Since several food depots in the city burned down, food had to be brought in from outside Hamburg. Most important, however, was the shortage of liquids. In one sector the after-hosing crews were fed exclusively by their own forces. Some units assigned to the Inner City, for instance, from Group Harbor, broke off fire fighting operations as a result and went to their own quarters for a meal, which caused a great time loss. At the Main Fire Station an emergency kitchen was established for the members of the technical services and was manned by wives of the personnel.

Field kitchens attached to units on assignment are absolutely necessary. (Other Civil Defense Communities have already put such a measure into practice.) Most of all, the kitchens would be able to furnish hot drinks. Again and again the necessity for availability of hot drinks was apparent. Also, it would seem advisable to equip the men with "Iron Rations." Haversacks and canteens should be carried even when the men are assigned to fire sites in their own sector.

11. Suggestions

a. Assignments

In case of conflagrations, assignments only make sense at the periphery where buildings might still be saved. It is recommended that the periphery of the fire be divided into sectors. Within these fire sectors reconnaissance can take place. Assignments should be limited to important objects; it is impossible to save everything.

b. General Suggestions

Bicycles should be carried on each fire truck, because motorcycles frequently went out of commission because of flat tires. High pressure valves are necessary; there should be one on each vehicle. Also, hose clips should be used again.

No coal should be stored in attics, because it rapidly burns successively through the various floors of a building. Emergency forces (army, labor batallions, etc.) must be equipped with shovels, so that glowing coals and other burning debris can be shoveled directly into the street.

Staircases should be made fireproof; many collapsed very quickly and blocked the exits from the air raid shelters. Even in

peacetime fires the disadvantages of wooden staircases were well established; for instance, in a fire at Steindamm 13 in May 1942, a Master Sergeant of the Fire Department was killed when the staircase collapsed.

12. Water Supplies

The Municipal water network failed right after the first attack because of direct hits on the water mains, so that in Groups West and Harbor the auxiliary water supplies had to be used. This presented no difficulties in Group Harbor; in Group West, on the other hand, because of its location on high ground and the lack of any natural open waters, operations became very difficult, particularly when the impossibility of refilling some of the water storage basins became apparent.

It would be advisable to have high-speed coupling pipes through which the water from portable fire engines positioned at open waters would be carried into the ascending pipes of buildings. Stationary pipelines of this kind would facilitate quick fire fighting action. Preparations for this measure have begun.

The underground water storage basins must be marked more clearly. Water storage basins with a minimum capacity of 500 cubic meters located no more than 200 to 250 meters from each other are absolutely necessary, particularly in the water-poor districts. All basins should have two approaches and two openings. In many cases the boards were torn off the enclosures by bomb explosions.

Fire Department Division IX Hamburg-Altona, August 13, 1943

To the Local Civil Defense Command of Fire Department Group West

RE: Assignment of Units during the time from 7/25 to 8/3/43

1. Assignment of Units

Date	Unit	In Own Sector	In Other Sectors
7/25/43	1/IX	Yes	
	2/IX	Yes	
7/28/43	1/IX	Yes	
	2/IX	---	V
7/30/43	1/IX	---	III
	2/IX	Partially yes	III
8/3/43	1/IX	---	III
	2/IX	Yes	III & VII

2. Provisions for Units on Duty

7/25/43 During the first attack day, there was no food issued at the fire sites. The crews received their first meal after returning to quarters between 12 noon and 6 p.m.

7/28/43 The first food (cold) was offered at about 6 a.m., the second meal (warm) at about 10 a.m.

7/30/43 The crews received no food until their return to quarters about 3 p.m.

8/3/43 The first unit did not receive any food until their return to quarters at about 5 p.m. The second unit received some cold and warm food from the Moorweide at about 2 p.m.

By and large, the provisions for the crews during their tours of duty left much to be desired.

(Signed) Max, Distr. Capt. of FPP

Fire Department Division IV Hamburg, August 13, 1943

RE: Report on Assignments, Provisions, and Tank Wagons

1. During the night of July 24/25, 1943, the following local units were assigned in Sector IV:

   - 6 fire brigades, one of which was a light brigade
   - 2 decontamination brigades
   - 1 water-borne fire brigade

   During the night of July 27/28, 1943, the following local units were assigned in Sector IV:

   - 6 fire brigades, one of which was a light brigade
   - 2 decontamination brigades
   - crew of one water-borne fire brigade

   During the night of July 29/30, 1943, in Sector IV and during the night of August 2/3, 1943, in Sector IV:

   - same units as during 7/27-28/43

2. Food was ordered by way of Administration Post IV to be delivered at the collection points and damage sites. During the first attack night, the food was good and sufficient.

   During the second attack night, there was no food given out at all and none was distributed until two days later and then in small quantities.

   After that, both cold and warm meals were adequate and good.

(Signed) Matthiesen
Distr. Captain of FPP and
Division Chief

Fire Department Division V · Hamburg, August 13, 1943

RE: Assignments 7/24/43 to 8/3/43

1. During the air attacks of 7/24 and 8/3/43, our own forces consisted of the following:

   - 3 Emergency Units
   - 15 Volunteer Fire Department Fire Squads from the County
   - 2 Volunteer Fire Department Fire Squads from the City

   During the first attack, one unit was assigned to damage site Karl Marx Platz under Group West.

   During the fourth attack, one unit was assigned to Adolf Hitler Platz at the State Opera.

2. Procurement of food was not possible until the end of the second attack. Even afterwards, the provisioning was very difficult, because natural gas and water were destroyed and field kitchens were not readied in time.

(Signed) Löffler
Major of FPP and
Division Chief

Fire Department Division VI Hamburg, August 13, 1943

RE: Assignment of Own Forces

During the time from July 25 to August 3, 1943, all units (17 in total) of Fire Division VI were assigned in our own sector, except for the Emergency Fire Unit 2/VI which was assigned with 2-1/2 fire brigades to Group West for one and a half days after the first attack to fight fires in their sectors.

Since August 2, the emergency brigades are assigned to the recovery of bodies in their own and other sectors.

Provisions were scarce and were distributed in insufficient quantitites.

(Signed) Höhse
Chief, Fire Division VI